

# A REVISION OF THE SOUTH AMERICAN SPECIES OF PARMELIA DETERMINED BY LYNGE

MASON E. HALE, JR.

## Introduction

Although the Norwegian lichenologist Bernt Lynge is remembered as the foremost authority on arctic lichens, early in his career he published several articles of fundamental importance on tropical lichens, especially in the genera *Anaptychia* and *Parmelia*. His major work (1914) involved the determination of the rich and well-prepared *Parmelia* collections, now preserved at Stockholm, of the various Regnell expeditions from 1892 to 1902 to Brazil and Paraguay. A second short paper (1917) merely added the descriptions of two new species, and a third paper (1925) summarized the determinations of miscellaneous Brazilian *Parmelias* at Uppsala, Stockholm, and Berlin.

Altogether Lynge identified a total of 110 taxa, 61 of them new to science, and gave exhaustive Latin descriptions of nearly all the species and excellent photographs of 30 taxa. It has been possible to reexamine 99 of these taxa; specimens of the remaining 11 were destroyed at Berlin or have otherwise not been located. The purpose of this report is to revise the determinations of these taxa with particular attention to adequate typification and analysis of chemical components. A full understanding of Lynge's species is essential before a monographic treatment of *Parmelia* in South America can be attempted.

The Regnell collections contained an extraordinarily large number of endemic species, many of which have never been collected again. Lynge, although on the whole he was a conservative taxonomist, wisely described these as new species instead of ascribing them to older names. At the same time the thoroughness of his work is attested by the fact that I have found it necessary to describe only one additional new species, *Parmelia microdactyla*. Most of my effort was expended in correcting misidentifications and synonymy stemming from Lynge's failure to typify the species correctly.

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### Chemistry of the Species

The chemical components of each specimen were determined by means of the standard microchemical crystal tests of Asahina (1954), chromatography (Wachtmeister, 1956), and fluorescence analysis (Hale, 1956). Chromatography is required to separate the pigmented substances; fluorescence analysis at 3,600 Å. is the easiest method of detecting the presence of alectronic acid in the medulla (by a bright white fluorescence) and lichexanthone in the cortex (by a brilliant orange-yellow fluorescence). Color tests supplementing the microchemical tests were made under a low power binocular directly on the thallus and medulla with fresh reagents. Lynge made a number of faulty chemical color tests which resulted in some misidentifications and in some species being described as new unnecessarily.

Thirty lichen substances, including 17 positively identified and 13 unknown, were demonstrated. A list of the 17 positively identified acids and the species in which they occurred is given below. Changes in the nomenclature of Lynge's names should be checked in the list of synonyms and misidentifications on p. 39.

- |   |  |
|---|--|
| <p>1. Alectronic acid:</p> <ul style="list-style-type: none"> <li><i>P. bahiana</i> Nyl.</li> <li><i>P. laongii</i> Lynge</li> <li><i>P. latissima</i> f. <i>microspora</i> Lynge</li> <li><i>P. melanothrix</i> (Mont.) Vain.</li> <li><i>P. melanothrix</i> f. <i>microspora</i> Lynge</li> <li><i>P. rigida</i> Lynge</li> <li><i>P. subproboscidea</i> Lynge</li> <li><i>P. subrugata</i> var. <i>arcuata</i> Lynge</li> <li><i>P. wainii</i> A. L. Smith</li> </ul> <p>2. Atranorine:</p> <p>Present in all taxa except:</p> <ul style="list-style-type: none"> <li><i>P. abstrusa</i> Vain.</li> <li><i>P. abstrusa</i> f. <i>laevigata</i> Lynge</li> <li><i>P. brasiliana</i> Nyl.</li> <li><i>P. brasiliana</i> var. <i>novella</i> (Vain.)<br/>Lynge</li> <li><i>P. chapadensis</i> Lynge</li> <li><i>P. crustacea</i> Lynge</li> <li><i>P. flava</i> var. <i>stellata</i> Lynge</li> </ul> | <p>2. Atranorine—Continued</p> <ul style="list-style-type: none"> <li><i>P. flava</i> var. <i>subdichotoma</i> Lynge</li> <li><i>P. malmei</i> Lynge</li> <li><i>P. minima</i> Lynge</li> <li><i>P. portoalegrensis</i> Lynge</li> <li><i>P. regis</i> Lynge</li> <li><i>P. regnellii</i> Lynge</li> <li><i>P. regnellii</i> f. <i>arida</i> Lynge</li> <li><i>P. rutidota</i> Hook. &amp; Tayl.</li> <li><i>P. silvatica</i> Lynge</li> <li><i>P. silvatica</i> var. <i>pinnata</i> Lynge</li> <li><i>P. silvatica</i> var. <i>radiata</i> Lynge</li> <li><i>P. viridescens</i> Lynge</li> </ul> <p>3. Barbatic acid:</p> <ul style="list-style-type: none"> <li><i>P. digitata</i> Lynge</li> <li><i>P. regnellii</i> Lynge</li> <li><i>P. uleana</i> Müll. Arg.</li> </ul> <p>4. Divaricatic acid:</p> <ul style="list-style-type: none"> <li><i>P. rupicola</i> Lynge</li> </ul> |
|---|--|

5. Fumarprotocetraric acid:  
*P. rutidota* Hook. & Tayl.  
*P. rutidota* f. *filizans* Lynge
6. Gyrophoric acid:  
*P. acariospora* Zahlbr.  
*P. coronata* Fée  
*P. marginalis* Lynge  
*P. minarum* Vain.  
*P. pluriformis* Nyl.  
*P. riograndensis* Lynge  
*P. rudecta* Ach.  
*P. sancti-angelii* Lynge  
*P. xanthina* (Müll. Arg.) Vain.
7. Lecanoric acid:  
*P. paraguariensis* Lynge  
*P. rissoensis* Lynge  
*P. tinctorum* Nyl.
8. Lichexanthone:  
*P. brasiliiana* Nyl.  
*P. brasiliiana* var. *novella* (Vain.)  
 Lynge  
*P. crustacea* Lynge  
*P. malmei* Lynge  
*P. minima* Lynge  
*P. regis* Lynge  
*P. silvatica* Lynge  
*P. silvatica* var. *pinnata* Lynge  
*P. silvatica* var. *radiata* Lynge
9. Norstictic acid:  
*P. abstrusa* Vain.  
*P. abstrusa* f. *laevigata* Lynge
10. Olivetoric acid:  
*P. fragilis* Lynge  
*P. revoluta* Floerke
11. Perlatolic acid:  
*P. wainioana* Lynge
12. Protocetraric acid—Continued  
*P. saccatiloba* Tayl.  
*P. silvatica* Lynge  
*P. silvatica* var. *pinnata* Lynge  
*P. silvatica* var. *radiata* Lynge
13. Protolichesteric acid:  
*P. canaliculata* Lynge  
*P. microsticta* Müll. Arg.  
*P. riograndensis* Lynge  
*P. xanthina* (Müll. Arg.) Vain.
14. Salacinic acid:  
*P. cetrata* Ach.  
*P. cetrata* var. *corniculata* Müll. Arg.  
*P. cetrata* ssp. *radiata* Lynge  
*P. cinerascens* Lynge  
*P. continua* Lynge  
*P. cristifera* Lynge  
*P. kamschadalis* var. *americana*  
 (Mey. & Flot.) Nyl.  
*P. latissima* Fée  
*P. magna* Lynge  
*P. microdactyla* Hale  
*P. nylanderii* Lynge  
*P. radians* Lynge  
*P. rupta* Lynge
15. Stictic acid:  
*P. conspersa* (Ach.) Ach.  
*P. eciliata* (Nyl.) Nyl.  
*P. longiconida* Lynge  
*P. portoalegrensis* Lynge  
*P. regnellii* Lynge  
*P. scrobicularis* Krempfh.  
*P. uleana* Müll. Arg.
16. Usnic acid:  
*P. abstrusa* Vain.  
*P. abstrusa* f. *laevigata* Lynge  
*P. chapadensis* Lynge  
*P. conspersa* (Ach.) Ach.  
*P. cristifera* Tayl.  
*P. cyliphora* (Ach.) Vain.  
*P. fatiscens* Lynge  
*P. flava* var. *stellata* Lynge  
*P. flava* var. *subdichotoma* Lynge  
*P. leucoxantha* Müll. Arg.  
*P. magna* Lynge  
*P. microdactyla* Hale  
*P. nylanderii* Lynge  
*P. portoalegrensis* Lynge  
*P. radians* Lynge  
*P. regnellii* Lynge  
*P. regnellii* f. *arida* Lynge  
*P. rutidota* Hook. & Tayl.

## 16. Usnic acid—Continued

- P. rutidota* f. *filizans* Lynge  
*P. uleana* Müll. Arg.  
*P. xanthina* (Müll. Arg.) Vain.

## 17. Vulpinic acid:

- P. cornuta* Lynge  
*P. persulphurata* Nyl.  
*P. sulphurata* Nees & Flot.

Unknown colorless substances were found in the following species:

- |   |   |
|---|---|
| <i>P. annae</i> Lynge                                     | <i>P. osseo-albida</i> Lynge                      |
| <i>P. brasiliana</i> var. <i>novella</i> (Vain.)<br>Lynge | <i>P. palmarum</i> Lynge                          |
| <i>P. capitata</i> Lynge                                  | <i>P. regis</i> Lynge                             |
| <i>P. ceracea</i> Lynge                                   | <i>P. regnellii</i> Lynge                         |
| <i>P. chapadensis</i> Lynge                               | <i>P. regnellii</i> f. <i>arida</i> Lynge         |
| <i>P. digitata</i> Lynge                                  | <i>P. riograndensis</i> Lynge                     |
| <i>P. gracilis</i> (Müll. Arg.) Vain.                     | <i>P. saccatiloba</i> Tayl.                       |
| <i>P. melanothrix</i> (Mont.) Vain.                       | <i>P. saccatiloba</i> f. <i>membranacea</i> Lynge |
| <i>P. mesotropa</i> Müll. Arg.                            | <i>P. subregressa</i> Lynge                       |
|   | <i>P. zahlbruckneri</i> Lynge                     |

Unknown pigments were discovered in the following species:

- |  |   |
|--|---|
| <i>P. chapadensis</i> Lynge                | <i>P. regnellii</i> Lynge                     |
| <i>P. cornuta</i> var. <i>crocea</i> Lynge | <i>P. regnellii</i> f. <i>arida</i> Lynge     |
| <i>P. crustacea</i> Lynge                  | <i>P. silvatica</i> Lynge                     |
| <i>P. lindmanii</i> Lynge                  | <i>P. silvatica</i> var. <i>pinnata</i> Lynge |
| <i>P. malmei</i> Lynge                     | <i>P. silvatica</i> var. <i>radiata</i> Lynge |
| <i>P. merrillii</i> Lynge                  | <i>P. uleana</i> Müll. Arg.                   |
| <i>P. minima</i> Lynge                     |   |

### List of Species

Lynge originally arranged his lists of 110 taxa in phylogenetic order. I have, for convenience, rearranged the species in alphabetical order and have numbered them consecutively. No descriptions are repeated from Lynge since he described meticulously nearly all the species in his 1914 article in *Arkiv för Botanik*, which is readily available in most larger libraries. I have, however, included supplemental information on the nomenclatural types, synonymy, range, color reactions and chemical components, and pertinent comments on the status of the species and their relatives. I have not attempted to improve or expand Lynge's excellent, though outdated key, for our knowledge of the Parmelias of South America is so incomplete that no key can do justice to the genus now.

The Malme specimens from the Regnell collections, all of which are preserved at Stockholm, are cited only by number or date, since Lynge gives complete label data for these in his lists. Holotypes and lectotypes are cited in full. Specimens collected by Dusén, Henschen, or Regnell, mostly preserved at Uppsala, are also cited in full.

Lynge did not designate holotypes for his new taxa in his publications, but he did write "originaleksemplar" on one herbarium packet

if two or more specimens were included in the original concept. I have selected such packets as lectotypes except in the case of *P. zahlbruckneri* Lynge (see p. 38). A summary of the new taxa reduced to synonymy and corrected identifications is given at the end of this list (p. 39).

1. *Parmelia abstrusa* Vain. Acta Soc. Faun. & Fl. Fenn. 7:64. 1890.—Lynge, 1914, p. 145, pl. 5, figs. 8, 9; 1925, p. 84.

Lectotype: Caraça, Minas Gerais, Brazil, *Vainio* 1347 (TUR).

Range: Brazil, Colombia, West Indies, Japan.

Additional specimens examined: *Malme* 1481B, 1537, 1857, 1865B, 1884, 2745, 2749B.

Reactions: Thallus K—, medulla K+ red, C—, KC—, P+ orange-red, norstictic and usnic acids present.

The specimens seen by Lynge fall within the range of variation of *Vainio's* species, although the thickness of the thallus is quite variable. A very close relative with thinner lobes is *P. jamaicensis* Vain., which also contains norstictic acid and usnic acid, and probably intergrades with *P. abstrusa* in the West Indies. Both species appear to be common on soil and rocks as well as on tree bark. *Parmelia microblasta* Vain., judging from the poor type material, is in this same group of isidiate species with norstictic acid but differs in lacking usnic acid.

2. *Parmelia abstrusa* f. *laevigata* Lynge, Ark. Bot. 13, No. 13:147. 1914.

*Parmelia subabstrusa* Gyel. Repert. Sp. Nov. 29:288. 1931. Based on *P. abstrusa* f. *laevigata* Lynge.

Lectotype: Bocca da Serra, Serra da Chapada, Mato Grosso, Brazil, *Malme*, June 15, 1894 (S).

Range: Known only from the type locality.

Reactions: Thallus K—, medulla K+ red, C—, KC—, P+ orange-red, norstictic and usnic acids present.

The lack of isidia and the conspicuous coronate apothecia set this entity quite apart from *P. abstrusa* f. *abstrusa*. In fact, we may well wonder why Lynge did not recognize it as a new species. The adoption of Gyelnik's name as a distinct species is recommended, although it does not clear up the confusion surrounding this difficult group. Two specimens seen by Lynge (*Malme* 2445 and March 7, 1894) react K— in the medulla and may be classified either as a chemical strain of *P. subabstrusa* or as an undescribed species more closely related to *P. relicina* Fr.

3. *Parmelia acanthifolia* Pers. in Gaudich. Voyage Uranie, Bot. 197. 1826.—  
Lynge, 1925, p. 84. PLATE 1

Type: Rio de Janeiro, Brazil, *Gaudichaud* 13 (P).

The specimen determined by Lynge in the Berlin Museum is presumably destroyed. Persoon's type is apparently an abnormal form

of *P. cetrata* Ach. The upper cortex is less reticulately rimose than expected, but the plant contains atranorine and salacinic acid and has spores ( $8-11 \times 12-16 \mu$ ) comparable to *P. cetrata*. Vainio's determination of *P. acanthifolia* from Brazil (*Lich. Bras. Exs.* 737) is based on *P. subcaperata* Krempfh.

4. *Parmelia acariospora* Zahlbr. Denkschr. Akad. Wiss. Math. Naturw. Wien 83:169. 1909.—Lynge 1914, p. 105.

Type: Barra Mansa, Itapecirica, São Paulo, Brazil, *Schiffner & Wettstein* (BPI, isotype).

Range: Brazil.

Additional specimens examined: *Malme* 2509B, 2532B\*, 2545.

Reactions: Thallus K+ yellow, medulla K—, C+ rose, KC+ red, P—, atranorine and gyrophoric acid present.

This uniform species is easily recognized by its thin fragile thallus and delicate isidia. *Parmelia minarum* Vain. is similar in chemistry and appearance but has a more ashy color and firmer lobes. *Parmelia granatensis* Nyl. and *P. chileana* Nyl. are also related to this species, but their exact status is unsettled.

5. *Parmelia amazonica* Nyl. Flora 68:611. 1885—Lynge, 1914, p. 101.

Type: Santarem, Amazon River, Bahia, Brazil, *Spruce* 111 (H).

Range: Florida, West Indies, Central America, Brazil.

Additional specimen examined: *Malme* 2408.

Reactions: Thallus K+ yellow, medulla K—, C—, KC+ rose, P+ orange-red, atranorine and protocetraric acid present (not proved microchemically in the type specimen).

*Parmelia amazonica* is distinguished by the presence of protocetraric acid. *Parmelia consimilis* Vain. of similar chemical constitution has thicker crowded isidia.

6. *Parmelia annae* Lynge, Ark. Bot. 13, No. 13:88, pl. 2, fig. 6. 1914.

Lectotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme* 2368B (S).

Additional specimen examined: *Malme*, June 27, 1894.

Reactions: Thallus K+ yellow, medulla K—, C—, KC+ red, P—, atranorine and two colorless unknowns, one forming tetragonal lamellae, the other needles in the reagent G.A.W.

The two specimens of *P. annae* and *P. ceracea* Lynge (see p. 9) agree chemically and morphologically with *P. recipienda* Nyl. (type: Brazil, Nylander Herbarium No. 35212, H), and both species are synonyms of *P. recipienda*. The medulla of *P. annae* was reported by Lynge to be K+ red. Evidently he obtained such a reaction from a single unpublished collection (Colonia Risso, Paraguay, *Malme* 1959, S), labeled *P. annae* but actually belonging to *P. subcaperata* Krempfh., which contains salacinic acid (K+ red).

7. *Parmelia bahiana* Nyl. Flora 68:612. 1885.—Lynge 1914, p. 134; 1925, p. 84.

Lectotype: Rio de Janeiro, *Glaziou* 1999 (H).

Range: Brazil.

Additional specimen examined: *Malme* 2545\*\*.

Reactions: Thallus K+ yellow, medulla K—, C—, KC+ red, P—, atranorine and alectoronic acid (in *Malme* 2545\*\*) or an unidentified substance (in the lectotype), other specimens not tested.

The only diagnostic character of *P. bahiana* is the KC + medullary reaction attributable to two different substances, as far as I can determine. Since the chemically different specimens are so close morphologically, I dare not describe Lynge's material as a new species, for it belongs to the particularly difficult nonisidiate, esorediate group of the section *Hypotrachyna*. The specimens collected by Dusén and Warming (UPS) were too fragmentary for certain identification.

8. *Parmelia balansae* Müll. Arg. Rev. Mycol. 10:1. 1888.—Lynge, 1914, p. 51.

Lectotype: Asunción, Paraguay, *Balansa* 8 (G).

Lynge determined *Malme* 201B as this species; the specimen has not been made available for study, but there is little doubt but that Lynge's determination is correct. *Parmelia balansae* is closely related to *P. consors* (see p. 11).

9. *Parmelia balansae* var. *sorediata* Müll. Arg. Rev. Mycol. 10:2. 1888.—Lynge, 1914, p. 53, *pl. 1, fig. 6*; 1925, p. 84.

*Parmelia subbalansae* Gyel. Repert. Sp. Nov. 33:288. 1931. Based on *P. balansae* var. *sorediata* Müll. Arg.

Type: Montevideo, Uruguay, *Arechavaleta* in 1887 (G).

Range: Argentina, Brazil, Uruguay.

Additional specimen examined: *Malme*, September 7–9, 1894.

Reactions: Thallus K+ yellow, medulla K—, C—, KC—, P—, atranorine present.

Lynge's specimen agrees perfectly with the holotype of the variety, which, following Gyelnik, should be recognized as a distinct species, *P. subbalansae* Gyel., which differs from *P. balansae* var. *balansae* in possessing laminal soredia. *Parmelia subbalansae* appears to be much more common than *P. balansae*.

10. *Parmelia borreri* (J. E. Smith) Turn. Trans. Linn. Soc. 9:148. 1808.—Lynge, 1925, p. 84.

*Lichen borreri* J. E. Smith, Eng. Bot. 25:1780. 1807.

The material of this species determined by Lynge was destroyed at Berlin. The citation as given above is the correct name for the currently accepted *P. dubia* (Wulf. in Jacq.) Schaer. non (Ach.) Floerke.

11. *Parmelia brasiliana* Nyl. Flora 68:611. 1885.—Lynge, 1914, p. 113.

Type: Organ Mountains, Rio de Janeiro, Brazil, *Weddell* (not seen).

Specimens examined: *Malme* 309, 312B. Reactions: Thallus K—, medulla K—, C—, KC—, P—, lichexanthone present.

Although the type has not been checked, the identity of this distinctive species has not been questioned by previous workers.

12. *Parmelia brasiliana* var. *glaziovii* (Müll. Arg.) Lynge, Nyt Mag. Naturv. 62:85. 1925.

*Parmelia glaziovii* Müll. Arg. Nuov. Giorn. Bot. Ital. 21:353. 1889.

The Henschen specimen cited by Lynge and preserved at Uppsala has not been available for study.

13. *Parmelia brasiliana* var. *novella* (Vain.) Lynge, Ark. Bot. 13, No. 13:115. 1914.—Lynge, 1925, p. 85.

*Parmelia novella* Vain. Acta Soc. Faun. & Fl. Fenn. 7:56. 1890.

Type: Minas Gerais, Brazil, *Vainio* 1028 (FH, isotype).

Range: Brazil.

Additional specimens examined: *Malme* 2246B; *Hemmendorf* in 1898 (UPS).

Reactions: Thallus K—, medulla K+ dull reddish, C—, KC+ reddish, P+ faint orange-red, lichexanthone and unknown substances present.

The status of this entity is not clear at this time. It probably falls nearer *P. silvatica* Lynge (see p. 34) than *P. brasiliana* because of the small, adnate thallus.

14. *Parmelia canaliculata* Lynge, Ark. Bot. 13, No. 13:28, *pl. 1, fig. 1*. 1914.—Lynge, 1925, p. 85.

Holotype: Cachoeira, Rio Grande do Sul, Brazil, *Malme* 1055, February 17, 1893 (S).

Range: Brazil, Argentina, Uruguay.

Reactions: Thallus K+ yellow, medulla K—, C—, KC—, P—, atranorine and protolichesteric acid present.

This unique species appears superficially to be in the *P. melanothrix* group, but on closer inspection it is found to have pseudocyphellae and lack cilia. Most of the specimens determined by Lynge in 1925 were destroyed at Berlin.

15. *Parmelia capitata* Lynge, Ark. Bot. 13, No. 13:59, *pl. 1, figs. 4, 5*. 1914.

Holotype: Rio Vermelho, near Bahia, Bahia, Brazil, *Malme*, October 1894 (S).

Range: Brazil, West Indies.

Reactions: Thallus K+ yellow, medulla K—, C—, KC—, P—, atranorine and an unidentified fatty substance near caperatic acid.



The name *P. capitata* has appeared in the literature several times, but such reports are usually based on misidentifications. *Parmelia capitata* is a small plant—so small that one would question its inclusion in the section *Amphigymnia*. *Parmelia sanctae-crucis* Vain. (cf. Hale, 1959a, p. 22), a common tropical species with similar chemistry, is twice the size of *P. capitata*. One specimen from the West Indies (Roseau, Dominica, *Evans*, US, YU) can probably be referred here.

16. *Parmelia ceracea* Lyngé, Ark. Bot. 13, No. 13:97. 1914.—Lyngé, 1925, p. 85.

Lectotype: Pilcomayo, Gran Chaco, Paraguay, *Malme*, September 7, 1893 (S).

Additional specimens examined: Caldas, Minas Gerais, Brazil, *Henschen* in 1868 (UPS).

Reactions: As in *P. annae* Lyngé.

The two specimens agree chemically and morphologically with *P. recipienda* Nyl. (see under *P. annae* Lyngé, p. 6), a rare but widespread species in Brazil, Argentina, and Paraguay.

17. *Parmelia cetrata* Ach. Syn. Lich. 198. 1814.—Lyngé, 1914, p. 90; 1925, p. 86.

Type: North America, *Muhlenburg* (PH, isotype).

Range: Cosmopolitan in temperate and tropical regions.

Additional specimens examined: *Malme* 463, June 25, 1894, October 14–16, 1902.

Reactions: Thallus K+ yellow, medulla K+ red, C–, KC–, P+ orange-red, atranorine and salacinic acid present.

Du Rietz (1924, p. 330) correctly circumscribed *P. cetrata* as an esorediate species with a reticulately rimose cortex and a uniformly rhizinate underside. Although specimens determined by Lyngé which I have been able to verify all lack soredia, his concept of the species included sorediate plants also, which should be referred to *P. reticulata* Tayl.

18. *Parmelia cetrata* f. *ciliosa* Viaud-Grand-Marais, Bull. Soc. Ouest France 2:156. 1892.—Lyngé, 1925, p. 86.

Material of this form which Lyngé examined was not available for study.

19. *Parmelia cetrata* var. *corniculata* (Kremplh.) Müll. Arg. Hedwigia 32:228. 1891.—Lyngé, 1914, p. 93; 1925, p. 86.

*Parmelia perforata* var. *corniculata* Kremplh. Naturhist. For. Kjöbenhavn Vid. Medd. 1873:11.

Type: Rio de Janeiro, Brazil, *Warming* (not seen).

Range: North and South America.

Specimens examined: *Malme* 313, September 3, 1893, and January 25, 1893. Reactions as in *P. cetrata* var. *cetrata*.

The correctness of this identification is undoubted.

**20. *Parmelia cetrata* subsp. *radiata*** Lynge, Ark. Bot. 13, No. 13:94. 1914.

Lectotype: Colonia Risso, near Río Apa, Paraguay, *Malme* 1834, September 23, 1893 (S).

Range: Brazil and Paraguay.

Additional specimen examined: *Malme*, June 15, 1894.

Reactions: As in *P. cetrata* var. *cetrata*.

Lynge based this subspecies on the more or less radiating arrangement of the lobes and noted in addition that the upper cortex was not reticulately rimose to the margins, but merely white-maculate. It is not uncommon, however, to find a similar condition in specimens of both *P. cetrata* and *P. reticulata* Tayl.

**21. *Parmelia chapadensis*** Lynge, Ark. Bot. 13, No. 13:153. 1914.

Holotype: Near Bocca da Serra, Serra da Chapada, Mato Grosso, Brazil, *Malme* 2297B, January 21, 1894 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellowish, KC+ strong yellow, medulla K+ yellow, C-, KC+ orange-yellow, P+ orange-yellow, usnic acid, an unidentified pale yellow pigment (in the medulla), and a P+ substance, probably near protocetraric acid.

This saxicolous species at first seems like an oversized specimen of the crustose *Rinodina oreina* (Ach.) Mass. rather than a *Parmelia*. It is a unique species with no near relatives in the genus.

**22. *Parmelia cinerascens*** Lynge, Ark. Bot. 13, No. 13:104. 1914.

Holotype: Paraguari, Paraguay, *Malme* 1498, August 2, 1893 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K+ red, C-, KC-, P+ orange-red, atranorine and salacinic acid present.

In gross appearance this species is near *P. minarum* Vain. but produces salacinic acid.

**23. *Parmelia coccinea*** Lynge, Ark. Bot. 15, No. 1:3. 1915.

*Parmelia ochrococcinea* Zahlbr. Cat. Lich. Univ. 8:562. 1932. A new name for *P. coccinea* Lynge non Clem.

Lynge (1925, p. 97) had already reduced this species to synonymy under *Pyxine coccifera* (Fée) Nyl., when Zahlbruckner made a new name.

**24. *Parmelia congruens*** Ach. Lich. Univ. 491. 1810—Lynge, 1925, p. 87.

Type: North America, *Swartz*. The identity of this species has long been a source of confusion to lichenologists. There is no specimen in the Acharian herbarium according to Mr. Teuvo Ahti (in litt.).

A presumed isotype at Uppsala is a pale yellow, nonisidiate plant of the section *Xanthoparmelia*, even though Acharius described it as "albo-pallescent . . . sordide albo." The chemistry of this fragmentary specimen is not clear.

Two specimens identified by Lynge have not been seen. A duplicate of one of them (Argentina, *Lorentz & Hieronymus*, M) is the type of *P. taractica* Krempfh., a recognized species in the section *Xanthoparmelia* not to be compared with *P. congruens*.

**25. *Parmelia consimilis*** Vain. Acta Soc. Faun. & Fl. Fenn. 7:58. 1890.—Lynge, 1925, p. 87.

Lectotype: Sitio, Minas Gerais, Brazil, *Vainio* 1133 (FH).

Range: Brazil, West Indies.

Reactions: Thallus K+ yellow, medulla K—, C—, KC+ rose, P+ orange-red, atranorine and protocetraric acid present.

The specimen of Henschen (UPS) examined by Lynge consists of an *Anaptychia* species and a fragment of a sorediate *Parmelia*, not *P. consimilis*, which is isidiate.

**26. *Parmelia consors*** Nyl. Flora 68:613. 1885.—Lynge, 1914, p. 95, *pl. 3*, *fig. 1*; 1925, p. 87.

Lectotype: Brazil, *Weddell* (H, Nylander Herbarium No. 35276).

Range: Brazil.

Additional specimen examined: *Malme* 1282.

Reactions: Thallus K+ yellow, medulla K—, C—, KC—, P—, atranorine present.

Malme's specimen is well developed and typical. This species must be very near *P. balansae* Müll. Arg. Both have a rigid, finely white-maculate thallus and produce only atranorine. *Parmelia consors* has a dark underside, densely rhizinate to the margins, whereas *P. balansae* becomes lighter brown at the margins with a narrow papillate or almost bare zone below.

**27. *Parmelia conspersa*** (Ach.) Ach. Meth. Lich. 205. 1803.—Lynge, 1914, p. 142; 1925, p. 87.

*Lichen conspersus* Ach. Lich. Suec. Prod. 118. 1798.

Type: Europe (not seen). According to Gyelnik (1936, p. 120), the Acharian type is a mixture of nonisidiate *P. conspersa* and isidiate *P. isidiata* (Anzi) Gyel. I have advocated the acceptance of both species (Hale, 1955).

Range: Cosmopolitan.

Specimens examined: *Malme* 563, 1346. Reactions: Thallus K—, medulla K+ yellow, C—, KC—, P+ pale orange, stictic and usnic acids present.

The two Malme specimens are isidiate and should be classified as *P. isidiata*, an entity which Lynge recognized as a variety. A

third specimen (*Malme* 248) lacking isidia is *P. flavida* Zahlbr. (see under *P. flava* Krempfh., p. 15).

- 28. *Parmelia conspersa* var. *hypoclysta*** Nyl. Syn. Meth. Lich. 1:391. 1860.—  
Lynge, 1925, p. 87.

The specimen seen by Lynge was destroyed at Berlin.

- 29. *Parmelia continentalis*** Lynge, Ark. Bot. 13, No. 13:111. 1914.—Lynge,  
1925, p. 87.

Holotype: Corumba, Mato Grosso, Brazil, *Malme* 48, August 1, 1894 (S).

Range: Brazil, Paraguay.

Reactions: Thallus K+ yellow, medulla K—, C—, KC—, P—, atranorine present.

The only distinguishing feature of this *Hypotrachyna* species is the exceptionally rigid thallus.

- 30. *Parmelia continua*** Lynge, Ark. Bot. 13, No. 13:109. 1914.

Holotype: Buriti, Serra da Chapada, Mato Grosso, Brazil, *Malme* June 19, 1894 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K+ red, C—, KC—, P+ orange-red, atranorine and salacinic acid present.

This unusual member of the section *Hypotrachyna* lacks soredia and isidia and produces salacinic acid. It may be a nonisidiate variant of *P. cinerascens* Lynge.

- 31. *Parmelia cornuta*** Lynge, Ark. Bot. 13, No. 13:76, pl. 2, fig. 5. 1914.

Holotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme* 2477, March 2, 1894 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K—, C—, KC—, P—, atranorine and vulpinic acid present.

*Parmelia cornuta* has the same chemical composition as the better known *P. sulphurata* Nees & Flot. but lacks isidia and has longer cilia and a more rigid thallus.

- 32. *Parmelia cornuta* var. *crocea*** Lynge, Ark. Bot. 13, No. 13:78. 1914.

*Parmelia crocea* (Lynge) Gyel. Repert. Sp. Nov. 29:287. 1931. This is a later homonym of *Parmelia crocea* (Ach.) Sprengl.

Holotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme* 2477 bis, March 2, 1894 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla flava K+ yellowish, C—, KC+ yellowish, P—, medulla crocea K+ purple, atranorine, a pale yellow-orange pigment (also known in *P. lindmanii* Lynge and

*P. merrillii* Lyngé (= *P. lyngeana* Zahlbr.), and an unidentified anthraquinone.

Although Lyngé relied on the orange-red lower medulla to differentiate this variety, it actually contains a yellow pigment entirely different from that in var. *cornuta* (vulpinic acid). On the basis of both spore size and chemistry, var. *crocea* is closer to *P. merrillii* Lyngé (see p. 24) than to *P. cornuta*. We should continue to recognize it as a variety rather than coin another new species name, at least until additional material throws more light on the range of variation in this group.

**33. *Parmelia coronata*** Fée, Essai Crypt. Ecorces, 123, pl. 31, fig. 2. 1824.—  
Lyngé 1914, p. 121; 1925, p. 88.

Type: American tropics (not seen); Fée's color plate permits almost certain identification of the species.

Range: Tropical America.

Specimens examined: *Malme* 2392, 2511Ba, 2522G, 2525a. Reactions: Thallus K+ yellow, medulla K—, C+ rose, KC+ red, P—, atranorine and gyrophoric acid present.

The Malme specimens are well developed and typical.

**34. *Parmelia cristifera*** Tayl. London Journ. Bot. 6:165. 1847.—Lyngé, 1914, p. 46.

Lectotype: Calcutta, India, *Wallich* (FH).

Range: Tropical regions, especially in the Pacific area.

Reactions: Thallus K+ yellow, medulla K+ red, C—, KC—, P+ orange-red, atranorine and salacinic acid present.

The single specimen cited by Lyngé (*Malme*, June 16, 1894) contains atranorine, protocetraric acid, and usnic acid, and has the upper cortex more or less reticulately cracked. It is certainly not referable to *P. cristifera* but may be allied to *P. dominicana* Vain. The material, however, is too poor for satisfactory determination.

**35. *Parmelia crustacea*** Lyngé, Ark. Bot. 13, No. 13:108, pl. 3, fig. 4. 1914.

Holotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme*, February 21, 1894 (S).

Range: Known only from the type locality.

Reactions: Thallus K—, medulla alba K—, C—, KC+ faint rose, P+ orange-red, medulla crocea K+ purple, lichexanthone, protocetraric acid, and an unidentified anthraquinone present.

This species is very closely related to *P. silvatica* Lyngé (see p. 34), from which it is distinguished by a more adnate growth habit. Lyngé's separation of the two species in his key (1914, pp. 20–21) into different groups (*Cyclocheila* and *Sublineares*) is entirely unsatisfactory.

36. *Parmelia crystallorum* Lynge, Ark. Bot. 13, No. 13:128. 1914.

Holotype: Corcovado, Rio de Janeiro, Brazil, *Malme* 59\*, August 14, 1892 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K-, C-, KC-, P-, atranorine present.

Lynge characterized the species by the large colorless crystals which precipitated from the medulla in KOH; the identity of these crystals is unknown, and the type specimen is too small and fragile for adequate chemical analyses. The species resembles *P. zahlbruckneri* Lynge (see under *P. gracilis*, p. 17) in general appearance, especially with regard to the lobation and the ivory or ashy colored shiny surface.

37. *Parmelia cyliphora* (Ach.) Vain. Acta Soc. Faun. & Fl. Fenn. 13:7. 1896.—  
Lynge, 1914, p. 60.

*Parmelia caperata* (L.) Ach. var. *cyliphora* Ach. Syn. Lich. 196. 1814.

*P. caperata* auct.

Type: North America (UPS, isotype). The Acharian isotype is somewhat smaller than but otherwise identical with *P. caperata* var. *caperata*. The identity of *Lichen caperatus* L. was first questioned by Vainio (1886), who discovered a specimen of *Cetraria pinastri* (Scop.) S. F. Gray in the packet labeled *Lichen caperatus* in the Linnaean Herbarium. He assumed that this was the type specimen and therefore used the epithet *caperatus* for the *Cetraria* species, reduced *pinastri* to synonymy, and resurrected the Acharian var. *cyliphora* as the valid name for *P. caperata* auct. A study of Linnaeus' original diagnosis (Sp. Pl. 1147, 1753), however, indicates that the type of *Lichen caperatus* is probably not to be found in the Linnaean Herbarium. Linnaeus based his species on old phrase-names by Royen, Guettard, Dillenius, and Morison. The type of one of these pre-Linnaean species must be selected as the lectotype of *Lichen caperatus*, an action which has never been taken. Both Dillenius (Hist. Musc. pl. 25, fig. 97A, B, 1741) and Morison (Hist. ox. 633, pl. 7, fig. 1, 1699) illustrate a broad lobed *Parmelia* apparently identical with *P. caperata* auct., not a narrow lobes species such as *Cetraria pinastri*.

Specimen examined: *Malme* 2156.

Reactions: Thallus K-, medulla K-, C-, KC+ rose, P+ orange-red, usnic and protocetraric acids present.

The specimen appears to be typical *P. caperata* except for the lack of soredia, a condition not unknown in North American plants.

38. *Parmelia digitata* Lynge, Ark. Bot. 13, No. 13:98, pl. 3, fig. 4. 1914.

Holotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme* 2545, March 12, 1894 (S).

Range: Brazil, West Indies.

Reactions: Thallus K+ yellow, medulla K—, C+ light orange, KC+ deep orange, P—, atranorine and barbatic acid present.

*Parmelia digitata* belongs to the difficult and highly variable *P. laevigata* group. It has distinct marginal laciniae and lobules much as in *P. lobulifera* Degel. from North Carolina. A specimen from Jamaica (*Imshaug* 14910, MSC) is identical with *Lynge's* type.

39. *Parmelia eciliata* (Nyl.) Nyl. in Fournier, Mex. Pl. I:3. 1872.—*Lynge*, 1914, p. 72. PLATE 1

*Parmelia crinita* var. *eciliata* Nyl. Flora 52:291. 1869.

Type: Orizaba, Mexico, *Bourgeau* in 1865 (H).

Range: Argentina, Brazil, West Indies, Mexico.

Additional specimen examined: *Malme* 627.

Reactions: Thallus K+ yellow, medulla K+ yellow, C—, KC—, P+ pale orange, atranorine and stictic acid present.

The *Malme* collection compares well with *Nylander's* holotype in spore size and lobation, but has somewhat shorter cilia. The species is discussed more fully under *P. urceolata* *Eschw.* (see p. 37).

40. *Parmelia fatiscens* *Lynge*, Ark. Bot. 15, No. 1:1. 1917. PLATE 2

Holotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme*, October 16, 1902 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K—, C—, KC+ rose, P+ orange-red, atranorine, protocetraric acid, and traces of usnic acid in the cortex.

This species is characterized by large coralloid outgrowths which cannot properly be classified as isidia or soredia, although they sometimes become sorediate or pustular-isidiate. These peculiar growths also occur in *P. fasciculata* *Vain.* from Colombia, which contains atranorine and protocetraric acid, and in an undescribed species from Liberia, Africa. Certain forms of *P. robusta* *Degel.* have an atypical formation of tiny sorediate laciniae which coalesce into fasciculate coralloid growths resembling those of *P. fatiscens*.

41. *Parmelia flava* *Kremplh.* var. *stellata* *Lynge*, Ark. Bot. 13, No. 13:150, pl. 5, figs. 5, 6. 1914.

*Parmelia flavida* *Zahlbr.* var. *stellata* (*Lynge*) *Zahlbr.* Cat. Lich. Univ. 6:137. 1929. *Parmelia flavida* is a new name for *P. flava* *Kremplh.* non *Rebent.*

Type: São João d'el Rey, Minas Gerais, Brazil, *Malme* 311, September 1, 1894 (S).

Range: Brazil.

Reactions: Thallus K—, medulla K—, C—, KC+ rose, P+ orange-red, usnic and protocetraric acids present.

The holotype of *P. flava* Krempfh. (Serra da Piedade, Minas Gerais, Brazil, *Warming* 294, M), which Lynge did not examine, has much broader, obtuse lobes (1.5–2.0 mm. wide) than the new variety (0.8–1.0 mm. wide), but is otherwise similar in chemistry and gross appearance.

**42. *Parmelia flava* var. *subdichotoma*** Lynge, Ark. Bot. 13, No. 13:149, *pl.* 5, *fig.* 7. 1914.—Lynge, 1925, p. 88.

*Parmelia flavida* Zahlbr. var. *subdichotoma* (Lynge) Zahlbr. Cat. Lich. Univ. 6:137. 1929.

Type: São João d'el Rey, Minas Gerais, Brazil, *Malme* 310, September 1, 1894 (S).

Range: Brazil.

Additional specimen examined: Caldas, Minas Gerais, Brazil, *Henschen* in 1868 (UPS).

Reactions: As in *P. flava* var. *stellata* Lynge.

This variety can hardly be distinguished from var. *stellata*. We have no choice but to maintain both varieties, which seem to be distinct from var. *flavida*, until the range of variation of the species is more completely known.

**43. *Parmelia fragilis*** Lynge, Ark. Bot. 13, No. 13:123. 1914.

Holotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme* 2365\*, February 19, 1894 (S).

Range: Brazil.

Reactions: Thallus K+ yellow, medulla K—, C+ orange-red, KC+ deep orange-red, P—, atranorine and olivetoric acid present.

This plant is identical in every respect with *P. intercalanda* Vain. (syntype: *Lich. Bras. Exs.* 899, FH). This species is apparently the first of the section *Hypotrachyna* in which olivetoric acid has been demonstrated. Lynge suggests a similarity with *P. microblasta* Vain., which does have the same gross appearance but which differs quite significantly in having isidia and norstictic acid (K+ red).

**44. *Parmelia fungicola*** Lynge, Ark. Bot. 13, No. 13:129. 1914.

Holotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme* 2438B, February 27, 1894 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K—, C+ rose, KC+ red, P—, atranorine present, gyrophoric acid suspected but not proved microchemically because of the scarcity of material.

At first glance *P. fungicola* seems no more than a small isidiate form of *P. coronata* Fée. The contaminating fungus on the underside is a conspicuous feature. Lynge erroneously gave the medullary reaction as K+ yellow and C—, an understandable mistake in view of the small size of the thallus.



45. *Parmelia gracilis* (Müll. Arg.) Vain. Ann. Acad. Soc. Faun. & Fl. Fenn. 7:55. 1890.—Lynge, 1914, p. 124.

*Parmelia laevigata* var. *gracilis* Müll. Arg. Rev. Mycol. 1:169. 1879.

*P. confusula* Zahlbr. Cat. Lich. Univ. 6:162. 1929. A new name for *P. gracilis* (Müll. Arg.) Vain., non Sprengel nec Müll. Arg.

Type: Boqueron de Bogotá, Colombia, *André* 923 bis, December 21, 1875 (G, holotype; US, isotype).

Range: Colombia, Brazil.

Additional specimens examined: *Malme* 2241, 2749.

Reactions: Thallus K+ yellow, medulla K+ reddish, C—, KC+ red, P+ pale orange, atranorine and unidentified substances present; the acetone extract is a thick pale orange crust.

*Parmelia confusula* Zahlbr. is antedated by *P. zahlbruckneri* Lynge, which is identical with the type of *P. gracilis* (Müll. Arg.) Vain. (see p. 38). A noteworthy feature of this saxicolous lichen, other than the peculiar chemical reactions, is the shiny, whitish gray upper cortex, often transversely cracked and infested by a small black fungus.

46. *Parmelia hieronymi* Lynge, Nyt Mag. Naturv. 62:88. 1925.

The specimen on which this species was based was destroyed at Berlin. I have seen no herbarium specimens agreeing with the original description.

47. *Parmelia isidiophora* Zahlbr. Sitzungsber. Akad. Wiss. Math. Naturw. (Wien) 111:420, pl. 1. 1902.—Lynge, 1925, p. 89.

Type: Botanical Garden, Rio de Janeiro, Brazil, *Höhnelt* 169 (not seen, but appears to be typical *P. caroliniana* Nyl. from Zahlbruckner's photograph).

Specimen examined: Caldas, Minas Gerais, Brazil, *Henschen* in 1868 (UPS).

The single Henschen collection, verified by Zahlbruckner, is typical *P. caroliniana* Nyl., a widespread corticolous species in North and South America (cf. Hale, 1959a, p. 17). The specimen contains atranorine and perlatolic acid.

48. *Parmelia kamtschadalis* (Ach.) Eschw. var. *americana* (Mey. & Flot.) Nyl. Ann. Sci. Nat. Bot., ser. 4. 11:215. 1859.—Lynge, 1925, p. 89.

*Evernia americana* Mey. & Flot. Verh. Kaiser Leopold Carol. Akad. Naturforsch. 19, suppl. 1:211. 1843.

Type: Tropical America (destroyed at Berlin).

Specimen examined: Serra da Itatiaia, Brazil, *Dusén*, May 1902 (UPS).

Reactions: Thallus K+ yellow, medulla K+ red, C—, KC—, P+ orange-red, atranorine and salacinic acid present.

The material conforms with the accepted concept of *P. americana* (Mey. & Flot.) Mont., which differs from *P. cirrhata* Fr. in being isidiate. Both species are widespread in mountains of tropical regions.

*Parmelia kamtschadalis* (Ach.) Eschw. is a completely unrelated species in the section *Xanthoparmelia*.

49. *Parmelia laceratula* Nyl. Mem. Soc. Imp. Sci. Nat. Cherbourg 5:105. 1857.—Lynge, 1914, p. 100, *pl* 3, *fig* 3.

Holotype: Burnet and Brisbane River, Australia, *Müller* (H).

Range: Australia.

Reactions: Thallus K+ yellow, medulla K—, C+ red, KC+ red, P—, atranorine and lecanoric acid present.

*Parmelia laceratula* is a synonym of *P. subflava* Tayl. (type: Van Diemen's Land, FH). The types of both species have peculiar coarse marginal isidia and no pseudocyphellae except on the receptacle of the apothecia. The Malme specimens (533 and 828) seen by Lynge have the same chemistry but are densely pseudocyphellate on the upper surface. They are closest to *P. riograndensis* Lynge (= *P. cf. bolliana* Müll. Arg. see p. 31), but the thallus is very fragile. Lynge gave an incorrect chemical test (C—) and failed to include the species with the other pseudocyphellate Amphigymnias.

50. *Parmelia laongii* Lynge, Ark. Bot. 13, No. 13:68, *pl* 1, *fig* 3. 1914.

Holotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme* 2392\*, February 21, 1894 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K—, C—, KC+ red, P—, atranorine and alectoronic acid present; cilia K+ violet.

*Parmelia laongii* is a member of the *P. melanothrix* group (see p. —), closest to *P. argentina* Krempf. but with smaller spores (8–10 × 16–18 $\mu$  vs. 10–13 × 19–23 $\mu$ ) and cilia K+ violet.

51. *Parmelia latissima* Fée, Ess. Crypt. Suppl. 119, *pl* 38, *fig* 4. 1837.—Lynge, 1914, p. 41.

Type: American tropics and Jamaica (not seen but well illustrated in color by Fée).

Range: Tropical regions.

Specimen examined: *Malme* 2742B. Reactions: Thallus K+ yellow, medulla K+ red, C—, KC—, P+ orange-red, atranorine and salacinic acid present.

Only this one Malme specimen seems to be typical *P. latissima*. Four other specimens examined by Lynge (*Malme* 2364, February 21, 1894, June 15 and June 25, 1894) contained atranorine and protocetraric acid and should be identified as *P. zollingeri* Hepp, a widespread tropical and subtropical species, apparently much more common than *P. latissima*. Aside from chemical differences, *P. zollingeri* seems to have slightly smaller spores than *P. latissima* (18–24 $\mu$  vs. 28–32 $\mu$ , both with the episporium 3–4 $\mu$  wide).

52. *Parmelia latissima* var. *corniculata* Krempfh. Flora 61:463. 1878.—Lynge, 1914, p. 44.

Holotype: Argentina, *Lorentz & Hieronymus* (M).

Range: Argentina, Brazil.

Additional specimens examined: *Malme* 2738, 2743B, 2512Ba.

Reactions: Thallus K+ yellow, medulla K-, C-, KC+ rose, P+ orange-red, atranorine and protocetraric acid present.

The specimens seen by Lynge correspond perfectly to Krempelhuber's original type. The K- reaction was overlooked by Lynge. If we should follow a strict chemical criterion, var. *corniculata* should be transferred to *P. zollingeri*, which also contains protocetraric acid. However, a formal recombination of the varietal name would be premature at this time, when the differences between *P. latissima* and *P. zollingeri* are so poorly understood.

53. *Parmelia latissima* f. *microspora* Lynge, Ark. Bot. 13, No. 13:45. 1914.

Lectotype: Near Bocca da Serra, Serra da Chapada, Mato Grosso, Brazil, *Malme* 2244\*, January 19, 1894 (S).

Additional specimen examined: *Malme* 2244.

Reactions: Thallus K+ yellow, medulla K-, C-, KC+ red, P-, atranorine and alectoronic acid present.

Both of the specimens identified by Lynge are the same as *P. wainii* A. L. Smith (see p. 29, under *P. proboscidea*). He described the form in part on the basis of a faulty color test, the medulla supposedly K+ yellow changing to red but actually K-.

54. *Parmelia latissima* var. *minima* Lynge, Ark. Bot. 13, No. 13:45. 1914.

Holotype: Buriti, Serra da Chapada, Mato Grosso, Brazil, *Malme* 2243C\*\*, January 20, 1894 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K-, C-, KC+ rose, P+ orange-red, atranorine and protocetraric acid present.

Lynge at first described this plant as a new species, "*P. sublatissima*," in the herbarium. It is a much smaller plant than *P. latissima*, although otherwise comparable in morphology, and contains protocetraric acid, more characteristic of *P. zollingeri* Hepp. We cannot validly judge this new variety on the basis of a single small specimen.

55. *Parmelia leucoxantha* Müll. Arg. Flora 64:85. 1881.—Lynge, 1914, p. 82.

Type: Apiahy, Brazil, *Puiggari* 1050, March 1880 (G).

Range: Brazil.

Additional specimen examined: *Malme*, April 25, 1894.

Reactions: Thallus K+ yellow, medulla K-, C-, KC+ rose, P+ orange-red, atranorine, protocetraric acid, and usnic acid present.

Hillmann (1939) considered Lynge's determination to be incorrect.

Müller's type consists of four or five pieces of lichen pasted on a single card. The bulk of the material is identical with Malme's plant in chemistry and morphology, but the largest piece is a mixture of *P. leucoxantha* and another very similar species, apparently *P. nylanderii* Lyngé (see p. 25), which has cilia and reacts K+ red (salacinic acid). It is probably this aberrant thallus on which Vainio (1900) based his K+ red reaction and report of sparse cilia. The K- eciliate material, equivalent to Lyngé's concept, should be designated as the lectotype of *P. leucoxantha*.

**56. *Parmelia lindmanii*** Lyngé, Ark. Bot. 13, No. 13:74. 1914. PLATE 3

Holotype: Porto Alegre, Rio Grande do Sul, Brazil, *Malme* 450, September 25, 1892 (S).

Range: Southern United States, Mexico, West Indies, Central and South America, Africa.

Reactions: Thallus K+ yellow, medulla K+ yellowish, C-, KC+ yellowish, P-, atranorine and an unidentified pale orange-yellow pigment (in the medulla) present.

This distinct species has a wide distribution in the tropics, yet it has almost always been misidentified in herbaria as *P. sulphurata* Nees & Flot. or *P. tinctorum* Nyl. (see Hale, 1959, p. 20). The pale yellowish pigment, also known in *P. merrillii* Lyngé (p. 24) and *P. cornuta* var. *crocea* Lyngé (p. 12), forms a long streak on chromatographic paper with butanol as a solvent. In contrast, vulpinic acid, which has a deeper lemon-yellow color, rises up the paper without any streaking. A chromatographic test is often necessary to separate the species from *P. sulphurata*.

**57. *Parmelia longiconida*** Lyngé, Ark. Bot. 13, No. 13:130, *pl. 3, figs. 7, 8*. 1914.—  
Lyngé, 1925, p. 89.

Holotype: Near Río Apa, Colonia Risso, Paraguay, *Malme* 1949, October 21, 1893 (S).

Range: Paraguay, Brazil.

Reactions: Thallus K+ yellow, medulla K+ yellow, C-, KC-, P+ orange, atranorine and stictic acid present.

This species is conspecific with *P. scrobicularis* Kremppl. from Brazil (holotype: Lagoa Santa, *Warming*, M). Two unusual characters are the pruinose apothecia, very rare in *Parmelia*, and the strongly reticulately rugose upper cortex. *Parmelia sbarbaronis* B. de Lesd. (Hale, 1959a, p. 23) differs only in having soredia and shorter conidia.

**58. *Parmelia magna*** Lyngé, Ark. Bot. 13, No. 13:83. 1914.—Lyngé, 1925, p. 89.

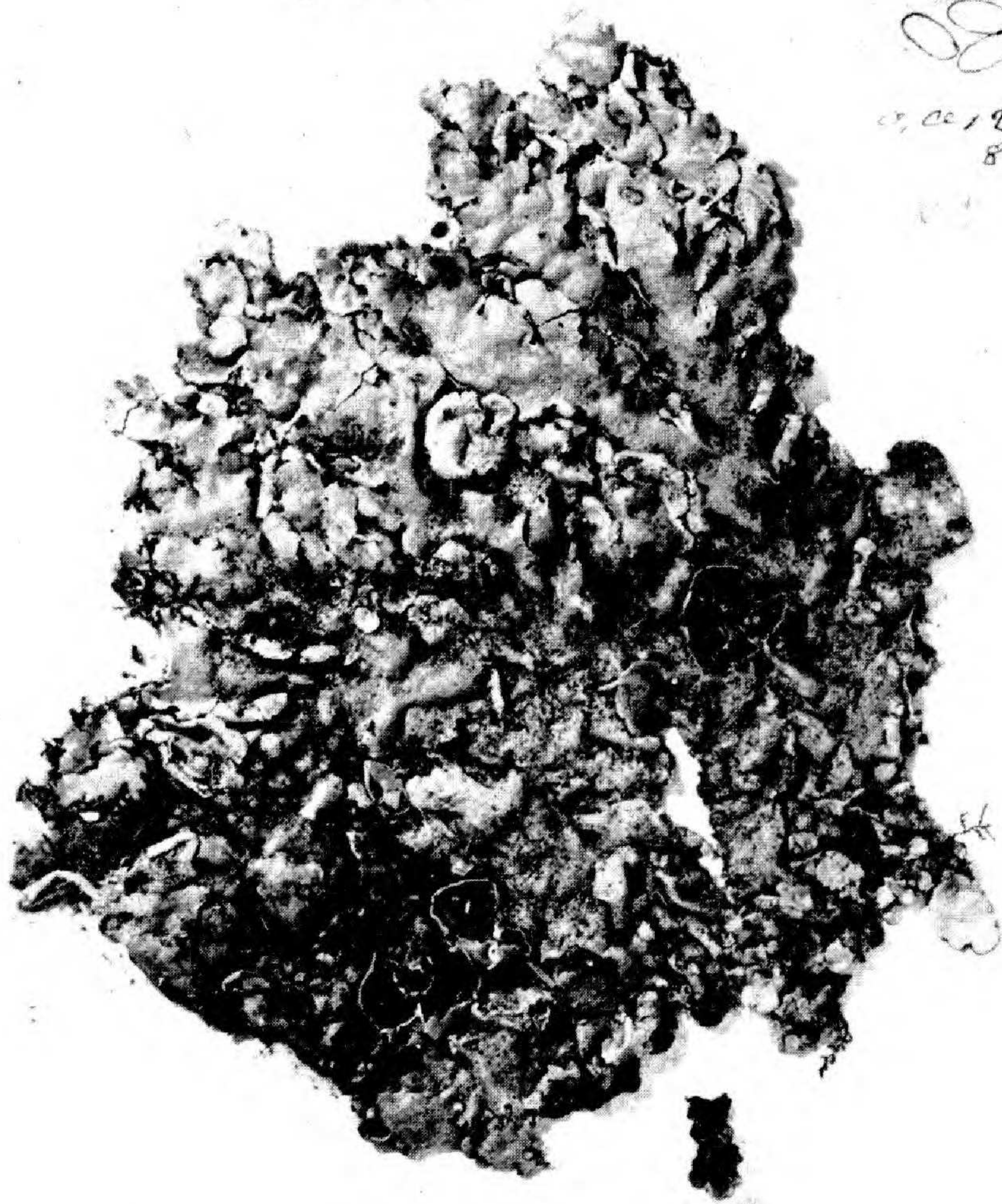
Holotype: São João d'el Rey, Minas Gerais, Brazil, *Malme* 269, August 31, 1892 (S).

Range: Brazil.

*P. acanthifolia*  
Pers.



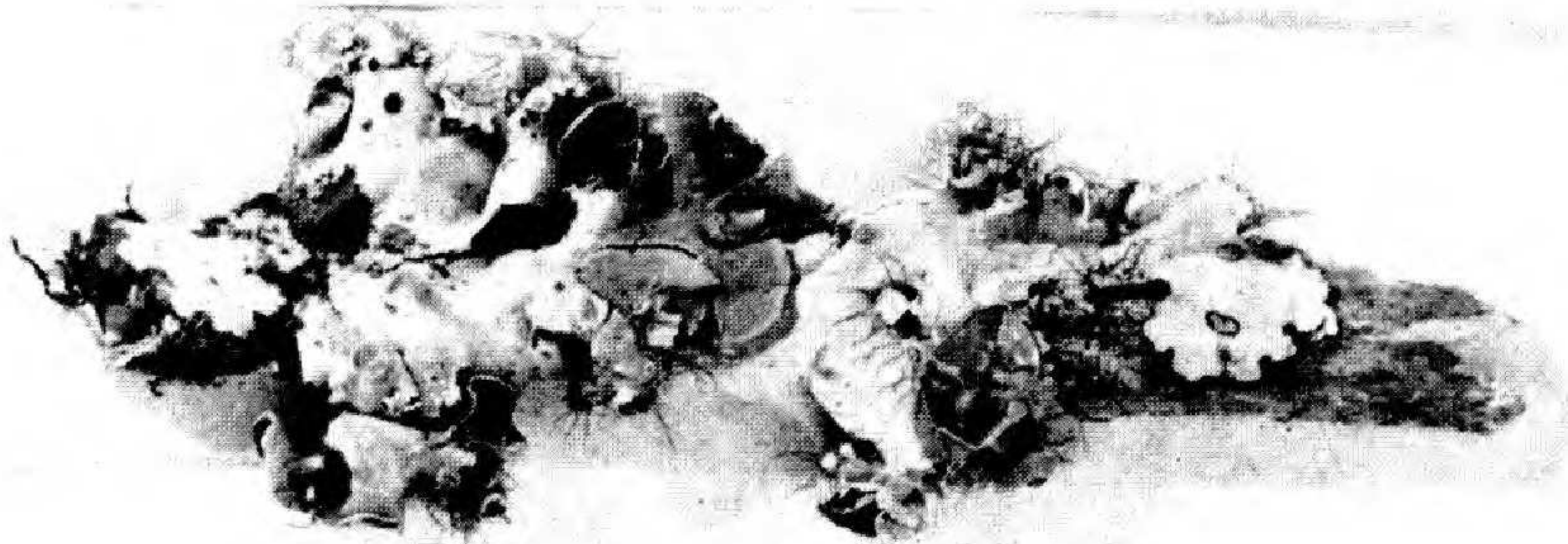
cc 12-16  
8-11



*Parmelia eciliata* (Nyl.) Nyl.  
(Holotype)

Mat. chim.: **Atranorine, stictic acid.**

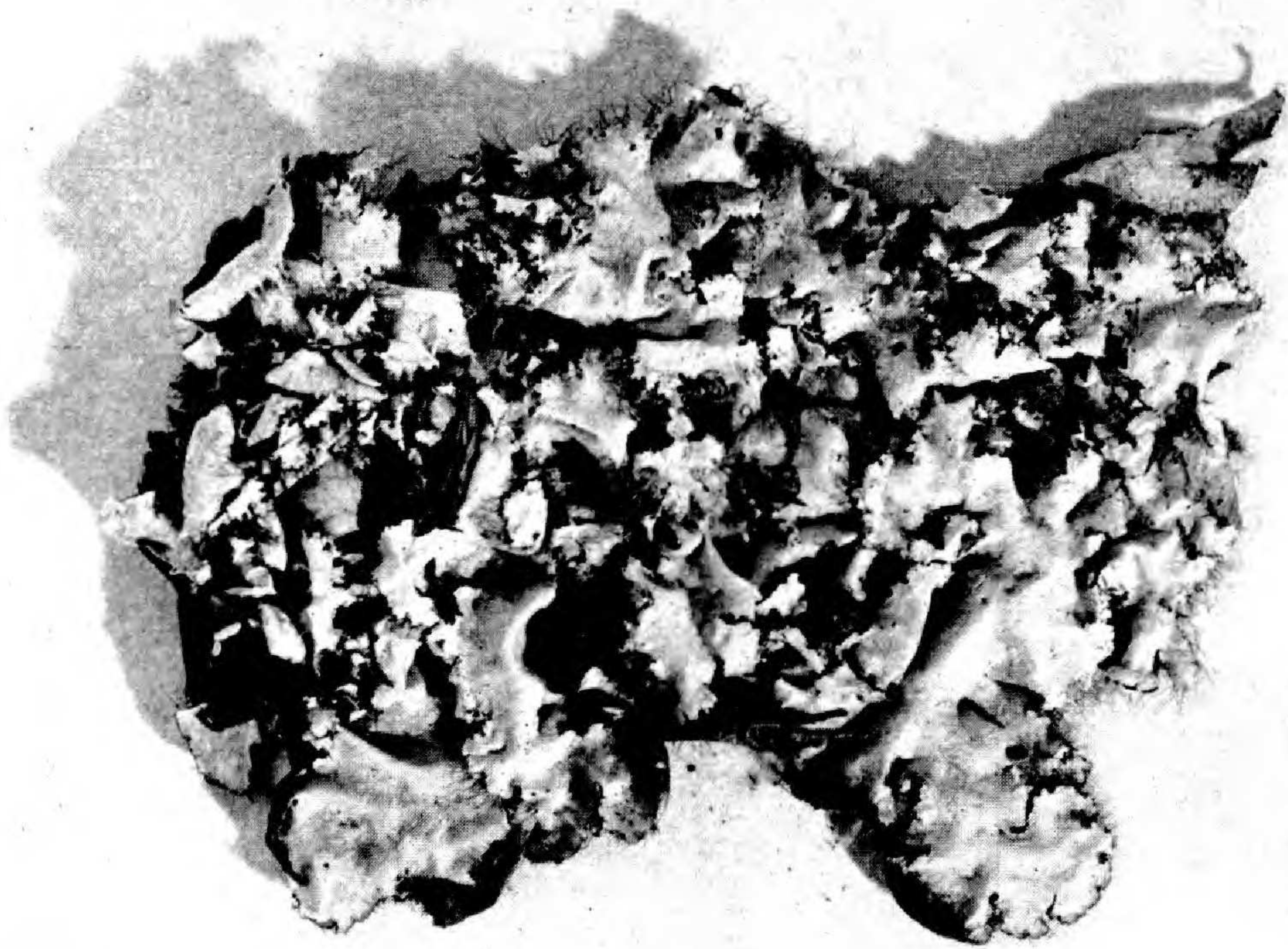
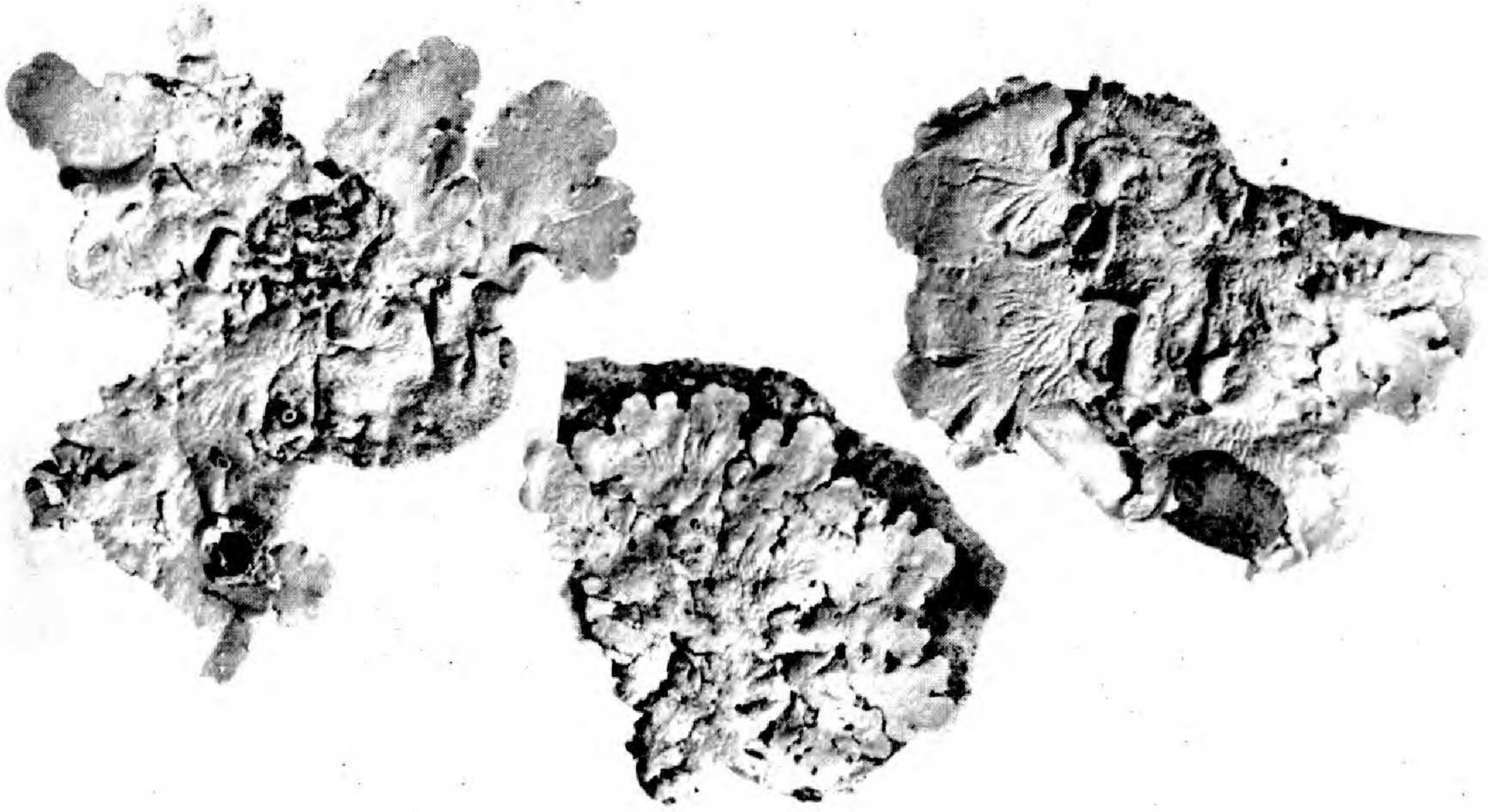
Examined by Mason E. Hale, Jr., U. S. National Museum III.1958



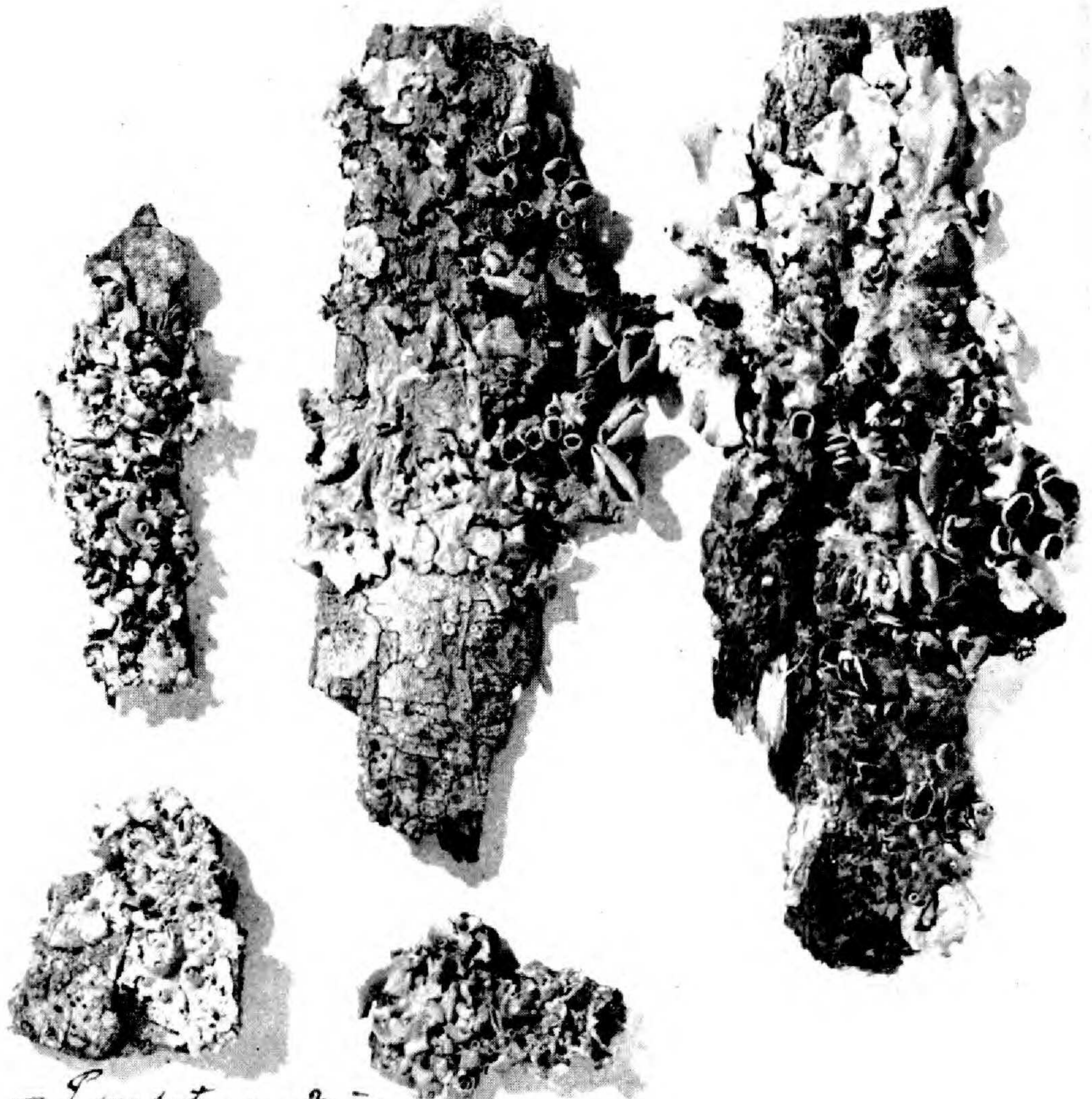
Above: *Parmelia acanthifolia* Pers. (holotype, Gaudichaud 13, P). Below: *Parmelia eciliata* (Nyl.) Nyl. (holotype, Bourgeau, H).



*Parmelia fatiscens* Lynge (holotype, *Malmé*, S).



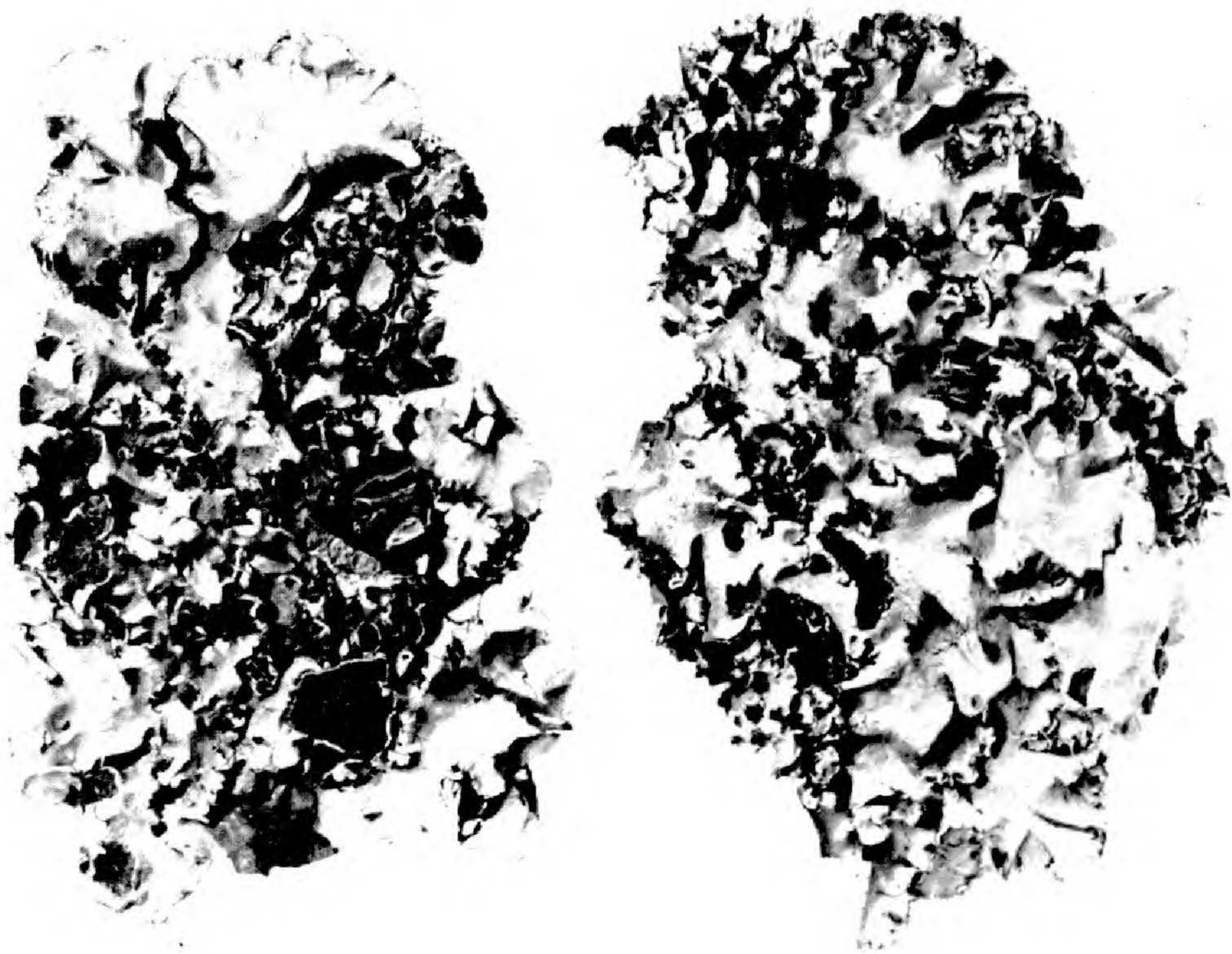
Above: *Parmelia lindmanii* Lynge (holotype, *Malme* 450, S). Below: *Parmelia proboscidea* var. *ornatula* Zahlbr. (holotype, *Damazio* 1090, G).



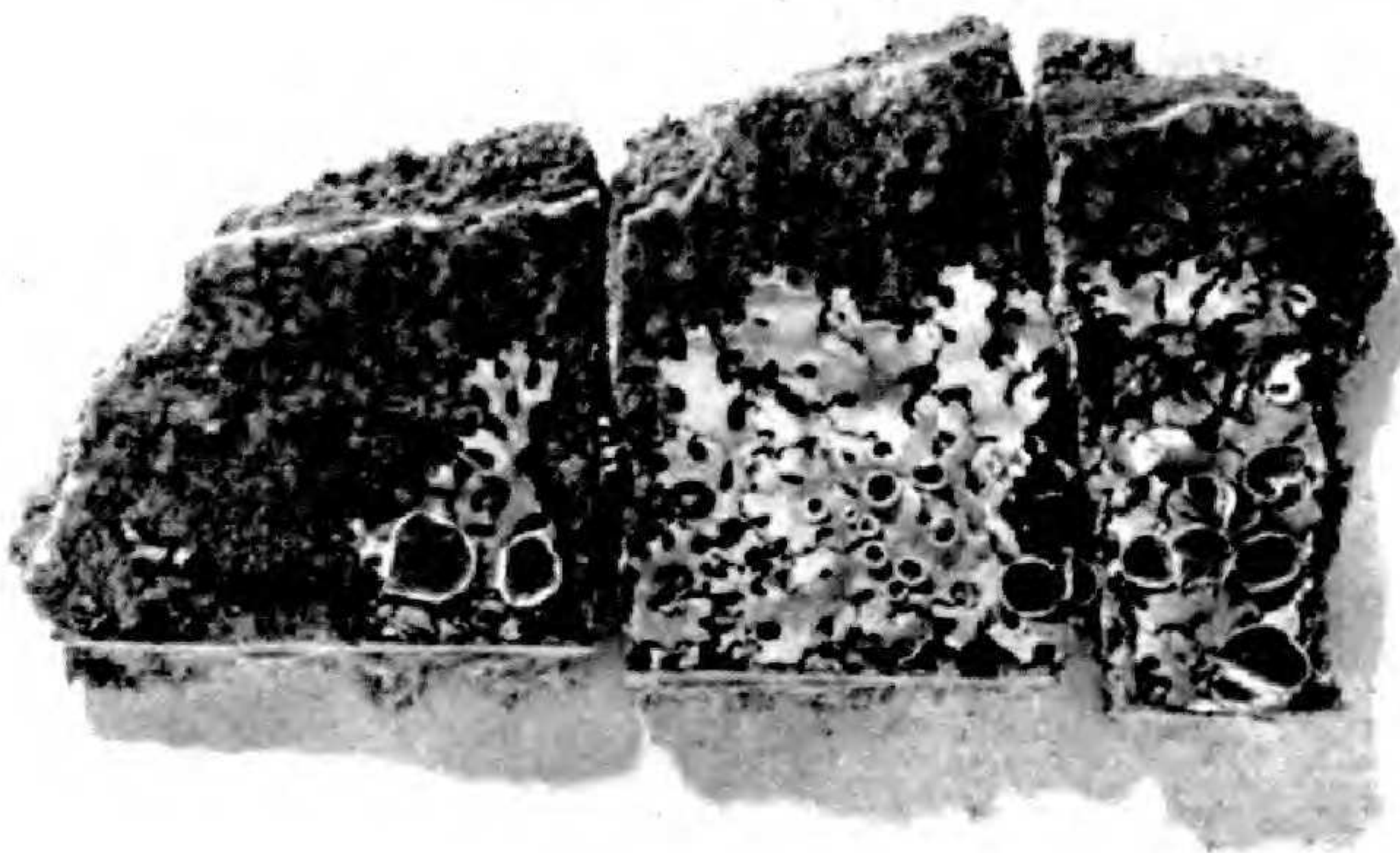
= *P. mesotropa* Müll. Arg.

*Parmelia mesotropa* Müll. Arg. (lectotype, Balansa, G).





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Above: *Parmelia sancti-angelii* Lyngé (holotype, Malme, S). Below: *Parmelia bicornuta* Müll. Arg. (holotype, Leyland, G).

Reactions: Thallus K+ yellow, medulla K+ red, C—, KC—, P+ orange-red, atranorine, salacinic and usnic acids present.

*Parmelia magna* is a large lichen, lacking isidia and soredia, with wide rotund, monophyllous lobes that easily break away from the main thallus. It is distantly related to *P. flavescens* (Kremplh.) Nyl.; its relation to other species with usnic acid may be illustrated in the following key:

1. Thallus isidiate; medulla K+ red or K—.
2. Medulla K+ red (salacinic acid) . . . . . **P. flavescens** (Kremplh.) Nyl.
2. Medulla K—.
3. Medulla C—, KC+ rose . . . . . **P. madagascariacea** (Hue) des Abb.
3. Medulla C+ rose (gyrophoric acid) or C—, KC—.
- P. xanthina** (Müll. Arg.) Vain. (see p. 38)
1. Thallus without isidia; medulla K+ red (salacinic acid).
4. Thallus fragile; lobes breaking apart . . . . . **P. magna** Lyngé
4. Thallus not fragile; lobes intact.
5. Lobes elongate, conspicuously ciliate.
- P. radians** Lyngé (= *P. delicatula* Vain., see p. 29)
5. Lobes short, more or less imbricate, cilia very sparse.
- P. microdactyla** Hale (see p. 21)

A second specimen identified by Lyngé as *P. magna* (Rio de Janeiro, Widgren, UPS) is a different plant, here proposed as a new species:

***Parmelia microdactyla* sp. nov.**

Thallus laxe adnatus, 8–10 cm. latus, dilute flavescens, irregulariter lobatus, lobis 8–12 mm. latis, 10–15 mm. longis, nonnihil imbricatus, superne planus, laevigatus, nec isidiatus, neque sorediatus, margine integro vel plus minusve dactyloideo-lobulato, lobulis discretis, seriatis, 0.2–0.4 mm. latis, 0.4–0.6 mm. longis, parce ciliato, ciliis usque ad 0.5 mm. longis, medulla alba, subtus niger et rhizinosus, ambitum versus castaneus, glaber. Apothecia ignota; pycnidia numerosa, conidiis 6  $\mu$  longis. Thallus KOH—, medulla KOH+ rubra, C—, KC—, P+ aurantiacus, acidum salacanicum et acidum usnicum continens.

Type in the Botanical Museum of the University of Uppsala, collected by Widgren, Rio de Janeiro, Brazil; isotype in the Riksmuseum, Stockholm.

This new species is closest to the isidiate *P. flavescens*, but the isidia are replaced by peculiar marginal lobules. Zahlbruckner unnecessarily complicated the nomenclature of this group when he was revising the South American collections of Schiffner and Wettstein. Krempelhuber had described *P. glaberrima*  $\beta$  *flavescens*, which Nylander raised to species rank in 1885. Although Nylander actually saw an isotype of *P. glaberrima*  $\beta$  *flavescens* when he made the new combination, Zahlbruckner followed Vainio (1896, p. 33) in the belief

that "*P. flavescens* Nyl." was based on a gray, not a yellow specimen. Of course it is immaterial whether Nylander applied the new combination to a correctly identified plant or not. The holotype of *P. glaberrima*  $\beta$  *flavescens*, while not as yellow as typical *P. xanthina* (Müll. Arg.) Vain., does contain usnic acid. Following his own peculiar rules of nomenclature, Zahlbruckner wanted to make the combination "*P. flavescens* Zahlbr.," but since this name was preoccupied by "*P. flavescens* Nyl.," he had to propose a new name, *P. protoflavescens*. For the supposedly gray plant seen by Nylander, he proposed the name *P. pseudoflavescens*, which is no more than a nomen nudum. The synonymy is summarized below:

*Parmelia flavescens* (Kremplh.) Nyl. Flora 68:607. 1885.

*P. glaberrima*  $\beta$  *flavescens* Kremplh. Flora 52:223. 1869. Type: Rio de Janeiro, Brazil, Glaziou (M).

*P. protoflavescens* Zahlbr. Denkschr. Akad. Wiss. Math. Naturw. Wien 83:176. 1909. Illegitimate name.

*P. pseudoflavescens* Zahlbr. Denkschr. Akad. Wiss. Math. Naturw. Wien 83:176. 1909. Nomen nudum.

**59. *Parmelia malmei*** Lynge, Ark. Bot. 13, No. 13:116, pl. 2, figs. 3, 4. 1914.

Holotype: Near Bocca da Serra, Serra da Chapada, Mato Grosso, Brazil, *Malme* 2750, June 5, 1894 (S).

Range: Brazil.

Reactions: Thallus K—, medulla alba K—, C—, KC+ rose, P+ orange-red, medulla crocea K+ purple, lichexanthone, protocetraric acid, and an unidentified anthraquinone present.

Differing only in the greater development of pustules, this species falls within the morphological and chemical range of *P. minima* Lynge (see p. 25) and should be considered synonymous with it. The species has some affinity with *P. formosana* Zahlbr. (Hale, 1958b, p. 89), a larger plant which also contains lichexanthone (but not protocetraric acid) and has similar pustular outgrowths.

**60. *Parmelia marginalis*** Lynge, Ark. Bot. 13, No. 13:112. 1914.

Holotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme* 2393\*\*\*\*, February 21, 1894 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K—, C+ rose, KC+ red, P—, atranorine and gyrophoric acid present.

*Parmelia marginalis* adds yet another element of variability to the already large and difficult group of isidiate species in the section *Hypotrachyna*. It is characterized by an ashy white thallus (as opposed to the buff hue of the *P. minarum* group). It resembles *P.*

*hookeri* Tayl. (C+ red, lecanoric acid) rather closely, but it should not be classified merely as a chemical strain of that species.

61. *Parmelia melanothrix* (Mont.) Vain. Ann. Soc. Faun. & Fl. Fenn. 7:30. 1890.—Lynge, 1914, p. 54; 1925, p. 90.

*Parmelia urceolata* var. *melanothrix* Mont. Ann. Sci. Nat. Ser. II, Bot. 2:372. 1834.

Type: Brazil, *Gaudichaud* 89 bis (not seen); Vainio apparently saw the type in the Paris Museum and found it to react KC—.

Range: Tropical regions.

Specimens examined: *Malme* 201, 314, 967 (S); *Glaziou* 1835; Caldas, Minas Gerais, Brazil, *Henschen* in 1868; *Regnell*, s.d.; Brazil, *Guillemin* 127; and Rio de Janeiro, *Warming* (UPS). Reactions: Thallus K+ yellow, medulla K—, C—, KC—, P—, atranorine and an unknown fatty substance present.

*Parmelia melanothrix* belongs to a small, well-circumscribed group of primarily tropical species which have a white-maculate cortex, marginal cilia, and a pale zone below at the margin contrasting with the black rhizinate center. Its relationship to the other species of this group in the Western Hemisphere is shown in the following key:

1. Margins soredate; apothecia unknown . . . . . **P. hypotropa** Nyl.
1. Soredia lacking; apothecia invariably present.
  2. Apothecia perforate.
    3. Salacinic acid present; spores  $5-7 \times 8-10 \mu$  . . . . . **P. uruguensis** Krempfh.
    3. Norstictic acid present; spores  $7-8 \times 12-14 \mu$ .  
 . . . . . **P. perforata** (Jacq.) Ach.
  2. Apothecia imperforate.
    4. Medulla KC—; spores  $10-12 \times 24-26 \mu$ ; episporium  $3 \mu$ .  
 . . . . . **P. melanothrix** (Mont.) Vain.
    4. Thallus KC+ red, alectoronic acid present; episporium less than  $2 \mu$ .
      5. Cilia K—.
      6. Thallus membranaceous; spores  $6-7 \times 17-19 \mu$ .  
 . . . . . **P. argentina** Krempfh.
      6. Thallus rigid, covered with large apothecia; spores (after Lynge)  $12-13 \times 17-24 \mu$  . . . . . **P. rigida** Lynge (see p. 31)
  5. Cilia K+ violet.
    7. Apothecia eciliate or at most sparsely ciliate, pale buff below at the margin; spores  $6-8 \times 11-14 \mu$ .  
 . . . . . **P. subproboscidea** Lynge (see p. 35)
    7. Apothecia ciliate, tinged below pale reddish-orange; spores  $8-10 \times 16-18 \mu$  . . . . . **P. laongii** Lynge (see p. 18)

Two additional specimens identified by Lynge as *P. melanothrix* (*Malme* 2522F\* and February 19, 1894) reacting KC+ red (not KC— as reported by Lynge) are typical *P. argentina* Krempfh. (holotype: Argentina, *Lorentz & Hieronymus*, M).

62. *Parmelia melanothrix* f. *microspora* Lyngé, ad int., Ark. Bot. 13, No. 13:56. 1914.

Lectotype: Villa Morra, Asunción, Paraguay, *Malme* 1585C, August 14, 1893 (S).

Additional specimens examined: *Malme*, September 3 and September 7 (two packets), 1893.

Reactions: Thallus K+ yellow, medulla K—, C—, KC+ red, P—, atranorine and alectoronic acid present.

As a new form "ad interim," this entity has no taxonomic status. The spores are smaller than those of typical *P. melanothrix*, and the chemical reaction as given by Lyngé (KC—) is incorrect. This combination of morphological and chemical characters is found in *P. subproboscidea* Lyngé (see p. 35), with which the *Malme* specimens are identical. A fourth specimen (*Malme*, September 3, 1893) is too fragmentary for verification.

63. *Parmelia merrillii* Lyngé, Ark. Bot. 13, No. 13:79. 1914.

*Parmelia lyngeana* Zahlbr. Cat. Lich. Univ. 6:243. 1929. A new name for *P. merrillii* Lyngé, non Vainio, Phil. Journ. Sci. 4:658. 1909.

Holotype: Coxipó Igreja, near Cuyabá, Mato Grosso, Brazil, *Malme* 2198B, December 27, 1893 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K—, C—, KC+ yellowish, P—, atranorine and an unidentified pale orange-yellow pigment (in the medulla) present.

The species is very close to *P. cornuta* var. *crocea* Lyngé (see p. 12) in morphology and chemistry, but the type material (the only collection of the species) is in poor condition.

64. *Parmelia microsticta* Müll. Arg. Flora 62:164. 1879—Lyngé, 1914, p. 24; 1925, p. 90.

*Parmelia borrieri* var. *allophylla* Krempf. Flora 61:438. 1878. Type: Argentina, *Lorentz & Hieronymus* (M).

Type: Montevideo, Uruguay (not seen).

Additional specimens examined: *Malme* 940, January 25, 1893; June 1893; September 11 and 13, 1894.

Reactions: Thallus K+ yellow, medulla K—, C—, KC—, P—, atranorine and protolichestic acid present.

This pseudocyphellate species is distinguished by a rigid thallus and a negative C reaction. It is otherwise similar to *P. bolliana* Müll. Arg.

- 64a. *Parmelia microsticta* var. *riograndensis* (Lyngé) Lyngé, Nyt Mag. Naturv. 62:90. 1925.

This combination was based on *P. riograndensis* Lyngé, which is discussed on p. 31.

65. *Parmelia minarum* Vain. Ann. Soc. Faun. & Fl. Fenn. 7:48. 1890.—Lynge, 1914, p. 106.

Type: Sitio, Minas Gerais, Brazil, *Vainio* 1040 (FH, isotype).

Range: Central and South America, West Indies, Africa.

Reactions: Thallus K+ yellow, medulla K—, C+ rose, KC+ red, P—, atranorine and gyrophoric acid present.

The specimen identified by Lynge (*Malme* 2243) cannot be referred to *P. minarum*. It is a large plant with marginal cilia, twice the size of typical *P. minarum*, although both entities contain atranorine and gyrophoric acid. This is in all probability a new species, which I would hesitate to describe from the single collection.

66. *Parmelia minima* Lynge, Ark. Bot. 13, No. 13 : 139, pl. 5, figs. 3, 4. 1914.

Lectotype: Near Bocca da Serra, Mato Grosso, Brazil, *Malme* 2747 bis, June 15, 1894 (S).

Range: Brazil.

Additional specimens examined: *Malme* 2747, s.n.

Reactions: Thallus K—, medulla alba K—, C—, KC+ rose, P+ orange-red, medulla crocea K+ purple, lichexanthone, protocetraric acid, and an unidentified anthraquinone present.

Lynge's "originaleksemplar" is an intimate mixture of an ashy white plant with sorediate pustules and a yellowish one with isidia. His Latin description includes the morphological and chemical characters of the ashy plant and the external color of the yellowish plant. There is no doubt that the ashy plant should be the lectotype of *P. minima*, of which *P. malmei* Lynge is probably a synonym (see p. 22). The yellowish plant is too fragmentary for identification.

67. *Parmelia nylanderi* Lynge, Ark. Bot. 13, No. 13:82. 1914.

Holotype: Near São Jeronymo, Serra da Chapada, Mato Grosso, Brazil, *Malme* 2747, June 3, 1894 (S).

Range: Brazil.

Reactions: Thallus K+ yellow, medulla K+ red, C—, KC—, P+ orange-red, atranorine, salacinic acid, and usnic acid present.

This saxicolous species may be related to *P. leucoxantha* Müll. Arg. (see p. 19), which contains protocetraric acid and lacks cilia.

68. *Parmelia olivaria* Hue, Lich. Extra-Europ. 195. 1899.—Lynge, 1925, p. 91.

The specimen from Argentina so identified by Lynge was destroyed at Berlin.

69. *Parmelia osseo-albida* Lynge, ad int., Ark. Bot. 13, No. 13 : 133. 1914.

Lectotype: Porto Alegre, Rio Grande do Sul, Brazil, *Malme* 595, October 15, 1892 (S).

Additional specimen examined: *Malme* 1330B.

Reactions: Thallus K+ yellow, medulla K+ reddish, C—, KC+ red, P+ pale orange, atranorine and unidentified substances present; the acetone extract is a pale orange crust.

This species, which must be rejected since it was proposed provisionally, differs from *P. zahlbruckneri* Lynge (see under *P. gracilis*, p. 17) in having more irregular lobing and a looser attachment to the rock substratum. Considering that the plants share an unusual chemistry, I do not believe that the slight morphological variation constitutes a valid specific difference. As a matter of fact, in his key Lynge separated *P. osseo-albida* ("medulla KOH non coloratur") from both *P. gracilis* and *P. zahlbruckneri* ("medulla KOH rubescens") by a simple error: The medullary reaction of *P. osseo-albida* is given in the diagnosis (p. 134) as "intus e flavo rubescens."

**70. *Parmelia pachyderma*** Hue, Lich. Extra-Europ. 137, pl. 4, figs. 1, 2. 1899.—  
Lynge 1914, p. 137; 1925, p. 91.

Type: Montevideo, Uruguay, *Dr. Courbon* 536 (not seen).

The specimen identified by Lynge (*Malme* 1320) is identical with *Parmelia fistulata* Tayl. (syntypes: Argentina, *Tweedie*, and Montevideo, Uruguay, *Darwin*, FH). Zahlbruckner (1929, p. 60) inexplicably reduced it to a variety of *P. cirrhata* Fr. The two syntypes, however, differ significantly from *P. cirrhata* in having protocetraric acid and atranorine, rather than salacinic acid, and a beautifully effigurate white-maculate cortex. Judging from illustrations of the types, Hue's long-accepted name *P. pachyderma* and *P. felipponei* Lindau should be placed in synonymy under *P. fistulata*.

**71. *Parmelia palmarum*** Lynge, ad. int., Ark. Bot. 13, No. 13:136. 1914.

Holotype: Buriti, Serra da Chapada, Mato Grosso, Brazil, *Malme* 2243C\*, January 20, 1894 (S).

Since Lynge proposed this new species "ad interim" and did not definitely accept it, it must be rejected. It is nevertheless a valid species, which may be characterized as follows, the description compiled from Lynge's original diagnosis of *P. palmarum*:

***Parmelia palmarum*** Lynge

*Parmelia palmarum* Lynge, ad. int., Ark. Bot. 13, No. 13:136, cf. pl. 4, figs. 1, 2. 1914.

Thallus laxe adpressus, mollis, cinereus vel vix flavescens, laciniis non bene radiantibus, 1–2 mm. latis, contiguis vel vulgo imbricatis, transversim rugosis, di- vel trichotomiter lobatis et crebre divergenter ramosis, lacinulis truncatis vel rotundatis et crenulatis, centrum versus lacinulis secundariis numerosis, parvis, digitatim vel coralliformiter ramosis, soreidiis, isidiis et ciliis deficientibus, subtus niger, ad apicem anguste castaneus, usque ad ambitum rhiziniis nigris, ramosis, sat dense instructus. Cortex superior 20–25  $\mu$  altus, medulla

alba, 80–150  $\mu$  alta, cortex inferior fuscus vel fusconiger, 13–15  $\mu$  altus. Apothecia numerosa, diam. 5–6 mm., sessilia, non perforata, disco flavofuscente, subopaco, non pruinoso; hymenium superne fuscescens, ceterum decolor, 50–55  $\mu$ ; sporae anguste limbatae, ovales, 9.5–11  $\mu$  longae, 5.3–6.6  $\mu$  crassae; conceptacula pycnoconidiorum subglobosa, 100–160  $\mu$  alta, 100–110  $\mu$  lata, conidiis 4–5  $\mu$  longis. Thallus K+ flavescens, medulla K–, C–, KC+ roseus, P–, atranorinum et materiam ignotam continens.

Type in the Naturhistoriska Riksmuseum, Stockholm, collected at Buriti, Serra da Chapada, Mato Grosso, Brazil, by G. A. Malme, No. 2243C\*, January 20, 1894.

This species is a close relative of *P. livida* Tayl. (type: New Orleans, Hook. Herb., FH), a common corticolous lichen in the southeastern United States with identical external appearance, although the thallus is more ashy white, and a similar KC+ reaction; *P. livida* differs principally in having smaller spores, 7–8  $\mu$  long, uniseriately arranged in the asci. *Parmelia bahiana* Nyl. could easily be confused with *P. palmarum*, except that it has a dense mat of rhizines projecting beyond the margins of the lobes. Lynge's "originaleksemplar" of *P. zahlbruckneri* (see p. 38) and one collection of *P. regis* Lynge (see p. 30) are both referable to *P. palmarum*.

72. *Parmelia paraguariensis* Lynge, Ark. Bot. 13, No. 13:71, pl. 1, fig. 7. 1914.

Holotype: Cierro Negro, Paraguari, Paraguay, Malme 1539, August 8, 1893 (S).

Reactions: Thallus K+ yellow, medulla K–, C+ red, KC+ red, P–, atranorine and lecanoric acid present.

This species is conspecific with *P. africana* Müll. Arg. (lectotype: Ghattas, Djur, Africa, Schweinfurth in 1877, G), a rather widespread species in Africa. A diagnostic character, aside from the unexpected occurrence of lecanoric acid, is the white-maculate upper cortex. *Parmelia rissoensis* Lynge (see p. 31) is merely a poorly developed specimen of this same species.

73. *Parmelia perforata* (Jacq.) Ach. Meth. Lich. 217. 1803.—Lynge, 1925, p. 91.

*Lichen perforatus* Jacq. Coll. Bot. 1:116, pl. III. 1786.

Type: Pennsylvania; not seen, but the original specimen is well illustrated in the color plate by Jacquin.

Range: Southeastern United States.

Lynge determined two packets as *P. perforata* (Caldas, Minas Gerais, Brazil, Henschen in 1868, UPS), but both are misidentified. One specimen is *P. subcaperata* Krempfh., and the other is *P. leucosemtheta* Hue, both of which contain atranorine and salacinic acid. *Parmelia perforata*, a species endemic to the United States, contains norstictic acid.



74. *Parmelia persulphurata* Nyl. in Cromb. Journ. Linn. Soc. London 16:219. 1877.—Lynge, 1914, p. 80.

Type: Not seen; the holotype was collected by Crombie in Bahia, Brazil. Nylander (Flora 68:606, 1885) later published the same diagnosis that he sent to Crombie in litt. and cited two specimens, from Cuba and Louisiana, which are the same as the holotype of *P. sulphurata* Nees & Flot. according to Hillmann (1939).

The Malme specimen (June 26, 1894) identified by Lynge lacks isidia and cannot therefore be *P. persulphurata* (if we are correct in assuming the latter species is synonymous with *P. sulphurata*). Actually it is closer to *P. cornuta* Lynge (see p. 12), but the material is far too poor for sound judgment.

75. *Parmelia pluriformis* Nyl. Synops. Lich. 381. 1858-60.—Lynge, 1925, p. 91.

Type: Minas Gerais, Brazil, *Weddell*, Nyl. Herb. No. 35585, (H).

Range: Brazil.

Additional specimen examined: São Paulo, Brazil, *Lindberg*, April 1854 (UPS).

Reactions: Thallus K+ yellow, medulla K—, C+ rose, KC+ red, P—, atranorine and gyrophoric acid present.

Lynge reported his determination with doubt, but the material is fully typical.

76. *Parmelia portoalegrensis* Lynge, Ark. Bot. 13, No. 13:147, pl. 5, fig. 13. 1914.

Lectotype: Porto Alegre, Rio Grande do Sul, Brazil, *Malme* 571, October 15, 1892 (S).

Additional specimen examined: *Malme* 560.

Reactions: Thallus K—, medulla K+ yellow, C—, KC—, P+ light orange, usnic and stictic acids present.

The tropics abound in minute isidiate species of the section *Xanthoparmelia* Vain. One of the first to be described, *P. adpressa* Krempfh., must be rejected as an orthographic variant and later homonym of *P. appressa* Mey. & Flot. The holotype of *P. adpressa* (Rio de Janeiro, *Glaziou* 3842, M) contains usnic acid and stictic acid and appears in other respects to be typical *P. isidiata* (Anzi) Gyel. Müller described a variety of this species, *P. adpressa* var. *stenophylloides* Müll. Arg., which Vainio raised to the rank of species as *P. stenophylloides* (Müll. Arg.) Vain. This entity also contains stictic acid but seems to be amply distinct from *P. isidiata* by reason of the very narrow lobes (to 0.5 mm wide). It has been suggested (cf. des Abbayes, 1958, p. 5) that *P. congensis* Stein., published in 1889, is identical with *P. stenophylloides* and should be the correct name for this entity. I have not checked the type of *P. congensis*, an African species, but the description seems to conform to *P. stenophylloides*.

*Parmelia portoalegrensis* is hardly distinguishable from this narrow lobed entity, whatever its correct name, except for the more crowded, contiguous lobes, and is perhaps merely a growth form on very smooth rock faces. It should be considered provisionally as a synonym of *P. congensis*.

77. *Parmelia proboscidea* Tayl. in Mack. Fl. Hibern. 2:143. 1836.—Lynge, 1914, p. 38; 1925, p. 91.

Type: Dunkerron Mountains, Ireland (FH); conspecific with the earlier *P. crinita* Ach. (cf. Hale, 1958a, p. 179).

Reactions: Thallus K+ yellow, medulla K+ yellow, C—, KC—, P+ pale orange, atranorine and stictic acid present.

Lynge followed Müller and Vainio in an incorrect interpretation of Taylor's species. A. L. Smith, who was familiar with *P. proboscidea* from Great Britain and knew that it was simply *P. crinita*, realized that the tropical plants so named were a different species. She gave them a new name, *P. wainii* A. L. Smith (Journ. Linn. Soc. London, Bot. 46:85, 1922), and cited as a basionym *P. proboscidea* (*sensu* Vainio, Acta Soc. Faun. & Fl. Fenn. 7:29, 1890). Vainio's *Lich. Bras. Exs.* Nos. 400 (FH), 582B, 973, and 1000 are therefore syntypes of *P. wainii*. Two packets labeled *P. proboscidea* by Lynge (*Malme* 314B and June 15, 1894) are identical with *Lich. Bras. Exs.* 400. Zahlbruckner (1904, p. 135) had actually described this entity earlier as *P. proboscidea* var. *ornatula* Zahlbr. (holotype: Serra do Ouro Preto, Damazio 1090, G; plate 3). *Parmelia wainii* is characterized by an ample thallus, marginally ciliate and without soredia or isidia; it produces atranorine and alectoronic acid (KC+ red). At the present time it is known from Brazil and Africa.

78. *Parmelia prolixa* var. *rosea* Lynge, Nyt Mag. Naturv. 62:91. 1925.

The specimen on which Lynge based this new variety was destroyed at Berlin.

79. *Parmelia radians* Lynge, ad int., Ark. Bot. 13, No. 13:85. 1914.

Holotype: São João d'el Rey, Minas Gerais, Brazil, *Malme* 203, August 30, 1892 (S).

Reactions: Thallus K+ yellow, medulla K+ red, C—, KC—, P+ orange-red, atranorine, salacinic acid, and usnic acid present.

*Parmelia radians* should be rejected as a provisional new species "ad interim." The type specimen is identical with *P. delicatula* Vain. (type: *Lich. Bras. Exs.* 1256, FH), although Lynge thought that Vainio's plant had a deeper yellow color than his own. The relation of *P. delicatula* to other tropical species with usnic acid in the section *Amphigymnia* is given in the key on p. 21.

**80. *Parmelia regis* Lyngé, Ark. Bot. 13, No. 13:126. 1914.**

Lectotype: São João d'el Rey, Minas Gerais, Brazil, *Malme* 178, August 30, 1892 (S).

Range: Known only from the type locality.

Reactions: Thallus K—, medulla K+ wine-red, C—, KC+ pale red, P+ pale orange, lichexanthone and unidentified substances present.

The type of *P. regis* cannot be told externally from *P. silvatica* Lyngé (see p. 34); it differs chiefly in lacking an anthraquinone pigment in the lower medulla. The two species are separated in Lyngé's key (p. 21) by: "1. Thallus KOH superne non coloratur" (*P. silvatica*), and "2. Thallus superne flavescens" (*P. regis*). Lyngé apparently established a yellow K test for *P. regis* from the two misidentified syntypes discussed below, since the "originaleksemplar" is K—. While *P. regis* thus delimited differs only in chemical characters from *P. silvatica*, it should be retained as a separate species until we are more familiar with the range of chemical variation in this group.

The other two specimens cited by Lyngé (*Malme* 941 and 2393\*\*\*\*) differ from the lectotype in lacking lichexanthone and reacting K+ yellow on the cortex and K— in the medulla. One specimen (2393\*\*\*\*) is identical with *P. palmarum* Lyngé (see p. 26 under *P. palmarum* Lyngé), while the other, which Lyngé had first called a new species in manuscript, *P. cachoeirae*, is too fragmentary for proper study.

**81. *Parmelia regnellii* Lyngé, Ark. Bot. 13, No. 13:140, pl. 5, figs. 1, 2. 1914.**

Lectotype: São João d'el Rey, Minas Gerais, Brazil, *Malme* 308, September 1, 1892 (S).

Range: Brazil.

Additional specimens examined: *Malme* 179, 2748B, 2745B, s.n.

Reactions: Thallus K—, medulla alba K+ yellowish, C+ yellowish, KC+ orange-yellow, P— (P+ in 2745B), medulla crocea K+ purple, usnic and barbatic acids (stictic in 2745B), an unidentified anthraquinone and other substances present.

*Parmelia regnellii* is a most remarkable lichen with a deep yellow thallus and in part a deep saffron medulla. Although Malme collected the species at three widely separated localities, it has not appeared in the literature or been seen in herbaria since Lyngé's description.

**82. *Parmelia regnellii* f. *arida* Lyngé, Ark. Bot. 13, No. 13:141. 1914.**

Holotype: Near Bocca da Serra, Serra da Chapada, Mato Grosso, Brazil *Malme* 2240, January 21, 1894 (S).

Range: Known only from the type locality.

Reactions: As in *P. regnellii* f. *regnellii*.

This form is much smaller than the typical form but has a similar chemistry.

**83. *Parmelia revoluta*** Floerke, *Deutsch. Lich.* 1:11. 1815—Lynge, 1925, p. 92.

Lynge based his record on two small fragments (*Henschen* in 1868, UPS), which in my opinion are not identifiable. Although *P. revoluta* has appeared in several lists of tropical American Parmelias, I doubt that the identifications are correct.

**84. *Parmelia rigida*** Lynge, *Ark. Bot.* 13, No. 13:50, *pl.* 2, *fig.* 2. 1914.

Holotype: Piratiny, Rio Grande do Sul, Brazil, *Malme* 827B, December 17, 1892 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K-, C-, KC+ red, P-, atranorine, and alectoronic acid present.

The exceedingly rigid thallus without soredia or isidia and the numerous large apothecia set this species apart from all other parmeliias. It may be placed in the *P. melanothrix* group (see. p. 23) because of the white-maculate cortex and the presence of alectoronic acid. Lynge mistakenly gave the medullary reaction as KC-.

**85. *Parmelia riograndensis*** Lynge, *Ark. Bot.* 13, No.13:26, *pl.* 1, *fig.* 2. 1914.

*Parmelia microsticta* Müll. Arg. var. *riograndensis* (Lynge) Lynge, *Nyt Mag. Naturv.* 62:90. 1925.

Lectotype: Porto Alegre, Rio Grande do Sul, Brazil, *Malme* 461, September 25, 1892 (S).

Reactions: Thallus K+ yellow, medulla K-, C-, KC-, P-, atranorine and protolichestic acid present.

Additional specimen examined: *Malme* 1282B. Reactions: Thallus K+ yellow, medulla K-, C+ rose, KC+ red, P-, atranorine and gyrophoric acid present.

Lynge based his description on two packets, one labeled "original-eksemplar," reacting C+ rose, which was erroneously designated by me (1958a, p. 180) as the holotype, and another reacting C-, which is the legitimate lectotype since it agrees with Lynge's C test. The two chemical strains are morphologically indistinguishable and near, if not equal to, *P. bolliana* Müll. Arg., which has the same chemical strains in the southwestern United States (Culberson & Culberson, 1956). A fuller understanding of *P. riograndensis* will depend on further study of *P. microsticta* Müll. Arg. and *P. squamuligera* Sant., but provisionally it can be regarded as a synonym of *P. bolliana*.

**86. *Parmelia rissoensis*** Lynge, *Ark. Bot.* 13, No. 13:69. 1914.

Holotype: Near Río Apa, Colonia Risso, Paraguay, *Malme* 1895B, October 7, 1893 (S).

Reactions: Thallus K+ yellow, medulla K-, C+ red, KC+ red, P-, atranorine and lecanoric acid present.

This entity is conspecific with *P. africana* Müll. Arg. and a poorly developed state of its synonymous species, *P. paraguariensis* Lynge (see p. 27).

**87. *Parmelia rudecta*** Ach. Syn. Lich. 197. 1814.—Lynge, 1914, p. 29; 1925, p. 92.

Type: North America, *Muhlenberg* (PH, isotype).

Reactions: Thallus K+ yellow, medulla K-, C+ red, KC+ red, P-, atranorine and lecanoric acid present.

Additional specimens examined: *Malme*, July 9, 1894; *Glaziou* 1834 (UPS). Both of these specimens contain gyrophoric acid (C+ rose).

The specimens are identical in morphology with the typical North American *P. rudecta*, which produces lecanoric acid constantly (Culberson & Culberson, 1956). The significance of the chemical difference in South American specimens has not yet been evaluated.

**88. *Parmelia rupicola*** Lynge, Ark. Bot. 13, No. 13:132, pl. 3, figs. 5, 6. 1914.

Holotype: Porto Alegre, Rio Grande do Sul, Brazil, *Malme* 1339, June 2, 1893 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K-, C-, KC-, P-, atranorine and divaricatic acid present.

*Parmelia rupicola* mimics the crustose *Lecanora muralis* (Schreb.) Rabh. very closely in size and habit. Divaricatic acid is known in only one other *Parmelia* species, *P. texana* Tuck, a widely distributed corticolous species in temperate and tropical regions.

**89. *Parmelia rupta*** Lynge, Ark. Bot. 13, No. 13:40. 1914.

Holotype: Río Negro, Gran Chaco, Paraguay, *Malme*, September 14, 1893 (S).

Range: Known only from the type locality.

Reactions: Thallus K+ yellow, medulla K+ red, C-, KC-, P+ orange-red, atranorine and salacinic acid present.

The single holotype collection has the appearance of *P. cetrata* Ach. with a reticulately rimose cortex. However, it has a rather distinct naked zone below at the margins. The species cannot be evaluated from this single rather poor specimen.

**90. *Parmelia rutidota*** Hook. & Tayl. Lond. Journ. Bot. 3:645. 1844.—Lynge, 1914, p. 151; 1925, p. 92.

Type: Van Dieman's Land (FH).

Range: Australia, South America.

Reactions: Thallus K—, medulla K—, C—, KC+ rose, P+ orange-red, usnic and protocetraric acids present.

Additional specimen examined: *Malme* 715.

The Malme specimen has the same morphology, habit, and spore size ( $13-16 \times 7-10 \mu$ ) as Taylor's type, but it contains fumarprotocetraric acid. It is probably no more than a chemical strain of little significance, and does not warrant species rank at this time. *Parmelia rutidota* is a plant of the southern hemisphere. Asahina's report from Japan (1952, p. 142) is a misidentified species of the *P. texana* group.

91. *Parmelia rutidota* f. *filizans* Lynge, Ark. Bot. 13, No. 13:153. 1914.

Holotype: Quinta, near Rio Grande, Rio Grande do Sul, Brazil, *Malme* 727, December 3, 1892 (S).

Range: Known only from the type locality.

Reactions: Thallus K—, medulla K—, C—, KC— or brownish, P+ red, fumarprotocetraric acid and usnic acid present.

This is a well characterized form with conspicuous filiform marginal laciniae.

92. *Parmelia saccatiloba* Tayl. Lond. Journ. Bot. 6:174. 1847.—Lynge, 1914, p. 65.

Lectotype: Pitcairn's Island, *Beechey* (FH, cf. Hale, 1958, p. 180).

Reactions: Thallus K+ yellow, medulla K—, C—, KC+ rose, P+ orange-red, atranorine and protocetraric acid present.

The five specimens thus identified by Lynge (*Malme* 1678\*\*, 2156B, 2392\*\*, s.n.) all contain atranorine and a fatty substance near caperatic acid, and lack the isidia characteristic of *P. saccatiloba*. They may be identified as *P. mesotropa* Müll. Arg. (type: Asunción, Paraguay, *Balansa* in 1878, G, plate 4), a common species which Lynge failed to study.

93. *Parmelia saccatiloba* f. *membranacea* Lynge, ad int., Ark. Bot. 13, No. 13:67. 1914.

Holotype: Pilcomayo, Gran Chaco, Paraguay, *Malme*, September 2, 1893 (S).

Reactions: Thallus K+ yellow, medulla K—, C—, KC—, P—, atranorine and an unknown fatty substance near caperatic acid present.

This form, which is not validly published, is also identical with *P. mesotropa* Müll. Arg. The smaller spores as reported by Lynge probably have no significance.

94. *Parmelia sancti-angelii* Lynge, Ark. Bot. 13, No. 13:35. 1914.—Lynge, 1925, p. 92. PLATE 5

Holotype: Colonia Santo Angelo, near Cachoeira, Rio Grande do Sul, Brazil, *Malme*, January 25, 1893 (S).

Range: Mexico, West Indies, South America, Africa, China.

Additional specimens examined: Caldas, Minas Gerais, Brazil, *Henschen* in 1868 (UPS).

Reactions: Thallus K+ yellow, medulla K-, C+ rose, KC+ red, P-, atranorine and gyrophoric acid present.

*Parmelia sancti-angelii* is a distinctive species now known to be widespread in tropical regions. In size and general morphology, it resembles *P. maxima* Hue (*P. claudelii* (Harm.) Vain.), which contains salacinic acid (K+ red). There is considerable variance in spore size, which is difficult to assess in a species so often collected sterile. Lyngé reported spores 26–33  $\mu$  long with a wide episporium; other tropical collections which I have measured have much smaller spores, only up to 16  $\mu$  long, with a thin episporium. Differences of this magnitude are generally not expected.

95. *Parmelia semilunata* Lyngé, Ark. Bot. 13, No. 13:23, pl. 5, figs. 10–12. 1914.

Holotype: Buriti, Serra da Chapada, Mato Grosso, Brazil, *Malme*, June 19, 1894 (S).

Range: Known only from the type locality.

Reactions: Specimens too fragmentary for testing; Lyngé reported the thallus K+ yellow, medulla C-, K-.

Externally *P. semilunata* could be mistaken for a species in the *P. coronata* group because of the small steel-gray thallus with coronate apothecia. The spores, however, are distinctly two-horned, a peculiar character known only in *P. schiffneri* Zahlbr. and *P. bicornuta* Müll. Arg., the latter species a much larger plant (plate 5) with lecanoric acid (type: Rio de Janeiro, *Leyland*, G). In view of the great morphological diversity of the three species it seems doubtful whether they should be joined together in a separate section of the genus (Section *Bicornutae* Lyngé, Ark. Bot. 13, No. 13:23, 1914) solely on the basis of the unique spores.

96. *Parmelia silvatica* Lyngé, Ark. Bot. 13, No. 13:118, pl. 5, fig. 14. 1914.

Lectotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme* 2393\*, February 21, 1894 (S).

Range: Brazil.

Additional specimens examined: *Malme*, March 3, 1894, June 25, 1894.

Reactions: Thallus K-, medulla alba K-, C-, KC+ rose, P+ orange-red, medulla crocea K+ purple, lichexanthone, protocetraric acid, and an unidentified anthraquinone present.

This well-circumscribed species is characterized by an unusual combination of chemical components. It is very near *P. regis* Lyngé

(see p. 30), which lacks the pigment, and not far removed from species in the *P. bahiana*-*P. palmarum* group (see p. 26 under *P. palmarum* Lynge).

**97. *Parmelia silvatica* var. *pinnata*** Lynge, Ark. Bot. 13, No. 13:120. 1914.

Holotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme* 2393\*\*\*, February 21, 1894 (S).

Range: Known only from the type locality.

Reactions: As in *P. silvatica* var. *silvatica*.

This variety is a broader-lobed plant than var. *silvatica*. I doubt that it could be told from the typical variety in a larger series of specimens, and I therefore do not believe it deserves any taxonomic rank.

**98. *Parmelia silvatica* var. *radiata*** Lynge, Ark. Bot. 13, No. 13:120. 1914.

Holotype: Santa Anna da Chapada, Mato Grosso, Brazil, *Malme* 2393\*\*, February 21, 1894 (S).

Range: Known only from the type locality.

Reactions: As in *P. silvatica* var. *silvatica*.

This variety differs from var. *silvatica* only in being more closely adnate to the bark, and in this respect it approaches *P. crustacea* Lynge (see p. 13) closely. I do not believe it deserves taxonomic status.

**99. *Parmelia soledica*** Nyl. Flora 68:608. 1885.—Lynge, 1925, p. 92.

A single specimen collected by Fries in Argentina (S) and cited by Lynge has not been available for study.

**100. *Parmelia subproboscidea*** Lynge, Ark. Bot. 13, No. 13:36. 1914.

Holotype: Assuncion, Paraguay, *Malme* 1678 in 1893 (S).

Range: Paraguay.

Reactions: Thallus K+ yellow, medulla K-, C-, KC+ red, P-, atranorine and alectoronic acid present; cilia K+ violet.

*Parmelia subproboscidea* has no relationship at all with *P. proboscidea* Tayl. (= *P. crinita* Ach.) but is a member of the *P. melanothrix* group (see under *P. melanothrix*, p. 23). It differs from *P. laongii* Lynge in having slightly smaller spores and a paler underside. *Parmelia melanothrix* f. *microspora* Lynge (see p. 24) is referable to this species. The recognition of *P. subproboscidea* makes the typification of *P. urceolata* Eschw. (Icon. Pl. Crypt. 23, 1827) essential. Though Eschweiler's color plate is not as clear as we would like, there is a strong possibility that it is the same as *P. subproboscidea*. In any event, when the type of *P. urceolata* is located and studied, that name will doubtless replace one of those of the presently recognized members of the *P. melanothrix* group.



- 101. *Parmelia subregressa*** Lynge, ad. int., Ark. Bot. 13, No. 13:58. 1914.  
*Parmelia subregressa*, Lynge, Nyt. Mag. Naturv. 62:93. 1925.

Holotype: Paraguari, Paraguay, *Malme* 1525B, August 7, 1893 (S).

Reactions: Thallus K+ yellow, medulla K-, C-, KC-, P-, atranorine and a fatty substance present.

*Parmelia subregressa* Lynge, "ad interim," dating from 1914, must be rejected as a provisional name. The holotype is identical morphologically and chemically with *P. mesotropa* Müll. Arg. (see p. 33, under *P. saccatiloba* Tayl.). In the second publication dating from 1925, Lynge listed the species without provisional status, so that this is the valid date of publication of *P. subregressa*. The specimen on which the second determination was based (Pampa Blanca, Argentina, *Fries*, S) has not been seen, but the type of the species would still be the Malme specimen.

- 102. *Parmelia subrugata*** Krempfh. var. **arcuata** Lynge, Ark. Bot. 13, No. 13:48. 1914.

Holotype: Porto Alegre, Rio Grande do Sul, *Malme* 440, September 25, 1892 (S).

Reactions: Thallus K+ yellow, medulla K-, C-, KC+ red, P-, atranorine and alectoronic acid present.

The holotype of *P. subrugata* Krempfh. (Serra dos Orgãos, Minas Gerais, Brazil, *Helmreichen*, M) has more or less arcuate conidia such as Lynge described for his new variety. Since the two entities are completely similar in morphology and chemistry, var. *arcuata* may be regarded simply as a synonym of var. *subrugata*.

- 103. *Parmelia sulphurata*** Nees & Flot. Linnaea 9:501. 1834.—Lynge, 1914, p. 75; 1925, p. 94.

Type: Destroyed at Berlin, but once examined by Hillmann (1939), who compared it with *P. persulphurata* Nyl. (see p. 28).

Range: Tropical regions.

Specimen examined: *Malme* 146. Reactions: Thallus K+ yellow, medulla K-, C-, KC-, P-, atranorine and vulpinic acid present.

Lynge's determination agrees with the present concept of the species. The density of isidia and marginal cilia varies widely.

- 104. *Parmelia tinctorum*** Nyl. Flora 55:547. 1872.—Lynge, 1914, p. 32; 1925, p. 94.

Type: Nylander apparently based the species on a specimen from the Canary Islands collected by Despréaux (not seen).

Range: Cosmopolitan in tropical and subtropical regions.

Specimens examined: *Malme* 1889, 1895 Ac, 1480, 2369, 2243C, 196, and September 7, 1893. Reactions: Thallus K+ yellow, medulla K-, C+ red, KC+ red, P-, atranorine and lecanoric acid present.